TENNESSEE DEPARTMENT

OF

ENVIRONMENT AND CONSERVATION

DOE OVERSIGHT DIVISION

ENVIRONMENTAL MONITORING PLAN

JANUARY through DECEMBER 2005

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LIST OF COMMON ACRONYMS AND ABBREVIATIONS

ASER	Annual Site Environmental Report (written by DOE)
ASTM	American Society for Testing and Materials
BCK	Bear Creek Kilometer (station location)
BFK	Brushy Fork Creek Kilometer (station location)
BJC	Bechtel Jacobs Company
BMAP	Biological Monitoring and Abatement Program
BNFL	British Nuclear Fuels Limited
BOD	Biological Oxygen Demand
BWXT	Y-12 Prime Contractor (current)
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAP	Citizens Advisory Panel (of LOC)
CCR	Consumer Confidence Report
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	Contaminants of Concern
COD	Chemical Oxygen Demand
CPM (cpm)	Counts per Minute
CRM	Clinch River Mile
CROET	Community Reuse Organization of East Tennessee
CWA	Clean Water Act
CYRTF	Coal Yard Runoff Treatment Facility (at ORNL)
D&D	Decontamination and Decommissioning
DOE	Department of Energy
DOE-O	Department of Energy-Oversight Division (TDEC)
DWS	Division of Water Supply (TDEC)
E. coli	Escherichia coli
EAC	Environmental Assistance Center (TDEC)
ED1, ED2, ED3	Economic Development Parcel 1, Parcel 2, and Parcel 3
EFPC	East Fork Poplar Creek
EMC	Environmental Monitoring and Compliance (DOE-O Program)
EMWMF	Environmental Management Waste Management Facility
EPA	Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, Trichoptera (May flies, Stone flies, Caddis flies)
ERAMS	Environmental Radiation Ambient Monitoring System
ET&I	Equipment Test and Inspection
ETTP	East Tennessee Technology Park
FDA	U.S. Food and Drug Administration
FRMAC	Federal Radiation Monitoring and Assessment Center
g	Gram
GHK	Gum Hollow Branch Kilometer (station location)
GIS	Geographic Information Systems
GPS	Global Positioning System
GW	Ground Water
GWQC	Ground Water Quality Criteria
HAP	Hazardous Air Pollutant
HCK	Hinds Creek Kilometer (station location)
IBI	Index of Biotic Integrity
IC	In Compliance
“ISCO” Sampler	Automatic Water Sampler
IWQP	Integrated Water Quality Program
K-####	Facility at K-25 (ETTP)

LIST OF COMMON ACRONYMS AND ABBREVIATIONS CONTINUED

K-25	Oak Ridge Gaseous Diffusion Plant (now called ETTP)
KBL	Knoxville Branch Laboratory
KEAC	Knoxville Environmental Assistance Center
l	Liter
LC_{50}	Lethal Concentration at which 50 % of Test Organisms Die
LMES	Lockheed Martin Energy Systems (past DOE Contractor)
LOC	Local Oversight Committee
LWBR	Lower Watts Bar Reservoir
MARSSIM	Multi-agency Radiation Survey and Site Investigation Manual
MBK	Mill Branch Kilometer (station location)
MCL	Maximum Contaminant Level (for drinking water)
MDC	Minimum Detectable Concentration
MEK	Melton Branch Kilometer (station location)
µg	Microgram
mg	Milligram
MIK	Mitchell Branch Kilometer (station location)
ml	Milliliter
MMES	Martin Marietta Energy Systems (past DOE Contractor)
µmho	Micro mho (mho=1/ohm)
MOU	Memorandum of Understanding
mR	Microroentgen
mrem	1/1000 of a rem – millirem
N, S, E, W	North, South, East, West
NAAQS	National Ambient Air Quality Standards
NAREL	National Air and Radiation Environmental Laboratory
NAT	No Acute Toxicity
NEPA	National Environmental Policy Act
NIC	Not In Compliance
NOAEC	No Observable Adverse Effect Concentration (to Tested Organisms)
NOV	Notice of Violation
NPDES	National Pollution Discharge Elimination System
NRWTF	Non-Radiological Waste Treatment Facility (at ORNL)
NT	Northern Tributary of Bear Creek in Bear Creek Valley
OMI	Operations Management International (runs utilities at ETTP under CROET)
OREIS	Oak Ridge Environmental Information System http://www-oreis.bechteljacobs.org/oreis/help/oreishome.html
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Association
OSL	Optically Stimulated Luminescent (Dosimeter)
OU	Operable Unit
PACE	Paper, Allied-Industrial, Chemical, and Energy Workers Union
PAM	Perimeter Air Monitor
PCB	Polychlorinated Biphenol
pCi	$1x10^{-12}$ Curie (Picocurie)
PCM	Poplar Creek Mile (station location)
pH	Proportion of Hydrogen Ions (acid vs. base)
PWSID	Potable Water Identification “number”
ppb	Parts per Billion

LIST OF COMMON ACRONYMS AND ABBREVIATIONS CONTINUED

ppm	Parts per Million
ppt	Parts per Trillion
PRG	Preliminary Remediation Goals
QA	Quality Assurance
QC	Quality Control
R	Roentgen
RBP	Rapid Bioassessment Program
RCRA	Resource Conservation and Recovery Act
REM (rem)	Roentgen Equivalent Man (unit)
RER	Remediation Effectiveness Report
ROD	Record of Decision
RSE	Remedial Site Evaluation
SLF	Sanitary Landfill
SNS	Spallation Neutron Source
SOP	Standard Operating Procedure
SPOT	Sample Planning and Oversight Team (TDEC)
SS	Surface Spring
STP	Sewage Treatment Plant
SW	Surface Water
TDEC	Tennessee Department of Environment and Conservation
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TLD	Thermoluminescent Dosimeter
TOA	Tennessee Oversight Agreement
TRE	Toxicity Reduction Evaluation
TRM	Tennessee River Mile
TRU	Transuranic
TSCA	Toxic Substance Control Act
TSCAI	Toxic Substance Control Act Incinerator
TSS	Total Suspended Solids
TTHM's	Total Trihalomethanes
TVA	Tennessee Valley Authority
TWQC	Tennessee Water Quality Criteria
TWRA	Tennessee Wildlife Resources Agency
U.S.	United States
UT-Battelle	University of Tennessee-Battelle (ORNL Prime Contractor)
VOC	Volatile Organic Compound
WCK	White Oak Creek Kilometer (station location)
WM	Waste Management
WOL	White Oak Lake
X-####	Facility at X-10 (ORNL)
X-10	Oak Ridge National Laboratory
Y-####	Facility at Y-12
Y-12	Y-12 Plant (Area Office)

Introduction

The Tennessee Department of Environment and Conservation, DOE Oversight Division (the division) under terms of the Tennessee Oversight Agreement Section A.7.2.1 is providing an annual environmental monitoring plan for the calendar year 2005. The plan consists of a series of individual work plans describing independent environmental monitoring and surveillance. Oversight of DOE's environmental monitoring and surveillance programs is also described. Chemical and radiological emissions in the air, water, biota, and sediment on the Oak Ridge Reservation and environs are emphasized. The goal is to assure that DOE Oak Ridge Operations has no adverse impact to public health, safety, or the environment. Results from our monitoring and our findings of the quality and effectiveness of the DOE's environmental programs are reported in our quarterly and annual status reports. An annual environmental monitoring report is also provided each spring that details the technical results of these studies.

This plan offers the Department of Energy the opportunity for review and consultation on the division's monitoring activities and to take split samples as needed. For situations such as storm events, non-permitted discharges, emergencies or spills, we may perform short notice or no notice sampling. DOE will be informed as soon as a decision is made to take short notice or no notice samples. Environmental monitoring is a dynamic process and will periodically change. Major changes to this plan will be made in writing to DOE.

The division or the Tennessee Department of Health, Environmental Laboratory and Microbiological Laboratory Organization (Laboratory Services) will process quantitative chemical samples. Laboratory Services has expertise in a broad scope of services and analysis. Certain analyses and Quality Assurance/Quality Control (QA/QC) samples are subcontracted out by Laboratory Services to independent certified laboratories. Bench level QA/QC records and chain of custody records are maintained by Laboratory Services for all samples collected by the division. The Laboratory Services Standard Operating Procedures are followed and also serve as a guide to the division's laboratory procedures. General sampling and analysis methods follow EPA guidelines.

Benthic macroinvertebrates and other biological samples are taxonomically identified at Laboratory Services, in the division's laboratory, or by Laboratory Services subcontractors. Common water quality measurements and radiological readings are done in the field with calibrated instruments. Environmental dosimeters are analyzed by outside vendors and not Laboratory Services. All work follows EPA, state, and instrument manufacturer's protocols as appropriate. Data loggers are used as available to reduce transcription errors.

Air Quality Monitoring

The division's integrated air quality monitoring is designed to verify and enhance the DOE monitoring of the air quality on the Oak Ridge Reservation, as well as the surrounding areas which may be impacted from DOE Oak Ridge Operations. The division implements EPA's Environmental Radiation Ambient Monitoring System (ERAMS) Air Program. We provide radiological surveillance of ambient air quality in the vicinity of the ORR and compare the results to that of the national ERAMS program. A precipitation monitor has been added to the ERAMs system from which radiological contaminants in rain and snow will be assessed. The ORR perimeter program is oversighted. In fact, we have arranged to use DOE's pre-filter media for our own radiological analysis and do direct trend comparisons. Portable samplers are also set up to

measure hazardous and radioactive contaminants around DOE demolition and remediation projects. In 2005 we have added EMWMF as an air-sampling site for fugitive emissions. Results are used to verify that DOE keeps contamination contained during cleanup and disposal activities. In the event of a large catastrophic release, any of these data could be used for consequence assessment and to guide recovery efforts, even in the community. For example, after the sodium fire in May 2004 at ETTP, special analysis from TDEC samplers were done to verify that no significant off site impact from the accident had occurred.

Biological/Fish and Wildlife

The division provides independent biological monitoring and oversight on and off the Oak Ridge Reservation to determine the impact of DOE operations. The division works in conjunction with the Tennessee Wildlife Resources Agency (TWRA), the Tennessee Valley Authority (TVA), and with other Tennessee Department of Environment and Conservation offices to coordinate valley wide monitoring efforts related to fishing advisories. Specific contaminant pathways are investigated on the Oak Ridge Reservation as well. Results are used to formulate recommendations on clean up and measure potential human and environmental risk. We are currently measuring impacts to aquatic biota, contamination in geese and deer and other indicator species such as lichens and watercress. We also are mapping invasive plants on a 3000-acre conservation easement.

Drinking Water

Public water systems on the Clinch River and Tennessee River can be adversely impacted by DOE activities on the Oak Ridge Reservation. The division's independent drinking water monitoring supports public water system's monitoring efforts related to releases from the Oak Ridge Reservation. The division implements EPA's Environmental Radiation Ambient Monitoring System (ERAMS) Drinking Water Program. Results are compared to the national program. The state provides labor and EPA provides expendables and analysis. Another note, because DOE plant water distribution systems operate at a fraction of historical capacity and can stagnate, we also monitor chlorine residuals in DOE facilities. The comprehensive goal is to document and trend that systems continue to be safe from radiological, chemical, and bacteriological contamination.

Groundwater Monitoring

The division's groundwater monitoring program provides information about Oak Ridge Reservation releases and potential impacts on health and the environment. Given the implications of contaminant transport off the Oak Ridge Reservation via groundwater, the division will continue its emphasis on the identification of groundwater pathways. These activities include monitoring of water supplies, wells, and springs on and off the ORR and hydrogeological investigations such as aquifer evaluations and dye traces. Integration of groundwater and surface water results refine concepts of groundwater behavior. Much groundwater tracing is opportunistic, as we must take advantage of favorable weather or sinkhole discoveries during construction, etc.

Radiological Monitoring

The division's radiological monitoring is directed toward the development of a comprehensive radiological monitoring system as prescribed by the Tennessee Oversight Agreement, Attachment C.2 "Radiological Oversight." The primary focus of the program is the detection of radiological

contamination with the potential to impact human health and the environment. Our radiological program contributes in all media areas and reviews CERCLA, NEPA, waste disposition, and other projects involving radionuclides. Autonomous monitoring includes facility surveys, gamma monitoring of the ORR and UF_6 yards, footprint reduction surveys, surplus sales survey, and real time gamma monitoring around active demolition and remediation sites. Automated gamma monitoring is being done at the Environmental Management Waste Management Facility in Bear Creek Valley, for example. The DOE weigh scales database is compared to our gamma monitoring data. Using time stamps to match data, we are monitoring radiation readings on waste shipments delivered for disposal and assuring that radioactive shipments are weighed and documented.

Surface Water Monitoring

The division measures trends in the quality of water and sediments in the Clinch River and Oak Ridge Reservation tributaries. Surface water is one of Tennessee's most important economic and environmental resources but local waterways rarely unconditionally meet all designated uses. For example, there are advisories on fish consumption from local reservoirs and streams. Legacy pollution from DOE, other industries, and non-point source origins are continuing problems. Long term monitoring can define success or failure of cleanup actions, source controls, and attenuation. Specifically, we are analyzing water from Bear Creek to isolate legacy source inputs. It is hoped that the long term monitoring strategy for the new Environmental Management Waste Management Facility can be positively affected and that existing sources/pathways can be found, analytically isolated, trended, and remedied. Another perspective, the Clinch and Tennessee Rivers are drinking water sources for several municipalities. Knowing pollutant concentrations has implications for drinking water obtained from surface waters. In 2005, more monitoring and investigation will be done closer to remediation projects and new construction sites such as SNS. We are also doing a significant amount of storm event related sampling. This will give us better resolution in evaluating the success of clean-up and remediation efforts.

Invitation for Public Comment

This plan is published to inform the public about state sampling on the ORR and environs. Any comments from the public on where or how our future sampling should be done are greatly appreciated. Comments can be sent to:

Darlene Seagraves
TDEC DOE-O
761 Emory Valley Road
Oak Ridge TN 37830

Comments can also be sent to darlene.seagraves@state.tn.us or faxed to (865) 482-1835.

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CHAPTER 1 AIR QUALITY MONITORING

Monitoring of Hazardous Air Pollutants at the East Tennessee Technology Park (ETTP)

Introduction

This independent monitoring project is conducted under authority of the Tennessee Oversight Agreement. It is a continuation of the ambient air-monitoring project initiated in 1997 in response to the heightened level of public concern regarding potential impacts to public health from the TSCA Incinerator emissions. Additionally, with the continuation of D&D activities, as well as the BNFL metals recovery project at the K-31 and K-33 buildings, further analyses of the potential impacts, if any, of these projects on the ambient air on and around the ETTP site is warranted.

Through use of the division's Hi-Volume ambient air samplers, levels of Arsenic, Beryllium, Cadmium, Chromium, Lead, Nickel and Uranium (as a metal only) in the ambient air at the ETTP site will be determined. The goal of this project will be accomplished through locating samplers at predetermined sampling locations currently in use for the 2004 calendar year monitoring project. These locations have been selected through wind rose data indicating their presence in the prevailing wind flow directions at the ETTP site. The sites are as follows:

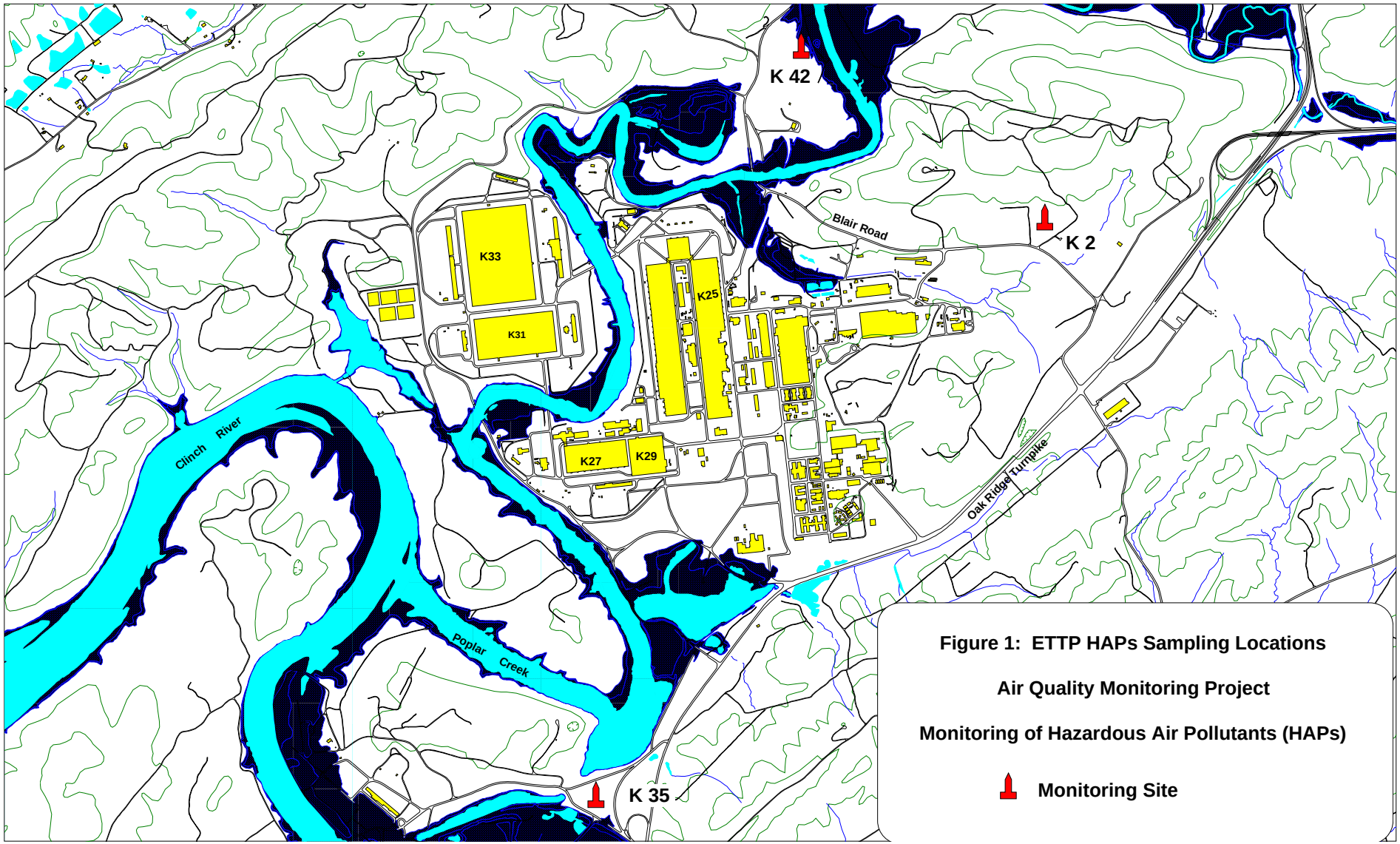
- K-2 Blair Road across from the TSCA Incinerator
- Station 42/TSCA-1 on Blair Road and
- Station 35/TSCA-2 site on Gallaher Road. (See Figure 1)

Although this project will sample for metals only, the Radiological Monitoring Oversight (RMO) program of the Department of Energy Oversight Division (TDEC) will continue ongoing radiological ambient air monitoring on the ETTP site.

Methods and Materials

On a weekly basis sample filters will be collected from the sampler and sent for analysis to the state laboratory in Nashville. The sampler will remain at the K-2 site, which is closest to the TSCA incinerator, throughout most of 2005. However, the option of moving the sampler to one of the other locations listed above or elsewhere around ETTP is a possibility should a need to do so be perceived by the staff.

Methods and protocols have been developed based on equipment maintenance manuals supplied by the manufacturer and sampling criteria tailored specifically to this project and DOE-O's mission and staffing levels. Each sampler is mounted on a small trailer and requires leveling and the fastening of a security chain when relocated after completion of a sampling cycle.


K 42
K 2
K 35
Blair Road
K33
K31
K25
K27
K29
Clinch River
Poplar Creek
Oak Ridge Turnpike
Figure 1: ETTP HAPs Sampling Locations
Air Quality Monitoring Project
Monitoring of Hazardous Air Pollutants (HAPs)
Monitoring Site

During each site visit, the sampler motor will be disassembled and the motor's brushes inspected for condition and evaluated for longevity. When it is not expected that the brushes will last until the next site visit, they will be replaced. The sampler will also be inspected to ensure that the orifice remains level and parallel to the ground. At each site visit the sampling cartridge will be removed and replaced with one holding a new filter. The cartridge will be covered both top and bottom, and the sample will be removed at the DOE-O laboratory and placed in a zip-lock bag. The 24-hour chart recording pressure differential will be removed and replaced weekly and its pen trace will be evaluated for average readings for the weekly period. Relevant information will be recorded on the reverse side of the chart. Readings of atmospheric pressure and ambient temperature are to be recorded on the chart, and the reading of the elapsed time indicator will also be taken. Proper chain of custody for samples will be maintained. DOE-O staff will maintain a quarterly calibration schedule that will be carried out in accordance with the manufacturer's specifications.

A report will be generated detailing the analytical results from each sampling location. Upon completion of the project a final report will be prepared presenting conclusions regarding ambient air HAPs metals.

Materials required for this project include:

1. Hi-Volume sampler
2. Trailer
3. Level
4. Extension cords
5. Tool kit
6. Motor brushes
7. Filters
8. Calibration kit
9. Flow charts
10. Waterproof marking pens
11. Project data/custody forms
12. Plastic sample bags

References

New York State Department of Environment Control, Draft New York State Air Guide-1, Guidelines for the Control of Toxic Ambient Air Contaminants, Appendix B of Air Guide-1, Ambient Air Quality Impact Screening Analyses, 1994 Edition.

Operations Manual for GMW Model2000H Total Suspended Particulate Sampling System, 1998 Graseby GMW Variable Resistance Calibration Kit # G2835.

Tennessee Department of Environment and Conservation, TDEC DOE-O Procedure Number: SOP-ES&H-004 Air Monitoring/Air Sampling.

Tennessee Department of Environment and Conservation, *Tennessee Oversight Agreement, Agreement between the U.S. Department of Energy and the state of Tennessee*. Oak Ridge, Tennessee. 2001.

Title 40 CFR Part 266 Appendix V.Boiler and Industrial Furnace Regulations

Yard, C.R., 2004. *Health, Safety and Security Plan*, Tennessee Department of Environment and Conservation, Department of Energy Oversight Division, Oak Ridge, Tennessee.

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CHAPTER 1 AIR QUALITY MONITORING

Monitoring of Hazardous Air Pollutants at X-10 and Y-12

Introduction

This independent monitoring project is conducted under authority of the Tennessee Oversight Agreement. It is a continuation of the ambient air-monitoring project initiated in 1998 in response to the public's concern regarding possible health effects resulting from the potential presence of hazardous air pollutants on and around the Oak Ridge Reservation.

Additionally, the continuation of remediation activities at ORNL, and the initiation of D&D activities as well as restart of uranium processing operations at Y-12 National Security Complex, presents an opportunity to further evaluate their impact on the ambient air on and around the these DOE sites.

Through use of the Division's Hi-Volume ambient air samplers, levels of Arsenic, Beryllium, Cadmium, Chromium, Lead, Nickel and Uranium (as a metal only) in the ambient air at the Y-12 National Security Complex and ORNL facilities will be determined. The goal of this project will be accomplished through locating samplers at predetermined sampling locations currently in use for the 2004 calendar year monitoring project. These locations have been selected through wind rose data indicating their presence in the prevailing wind flow directions at each site. The sites are as follows:

- ORNL: X-10E - ERAMS station east of the main entrance to the site
  X-10W - Station No. 3 west of the site (See Figure 1)

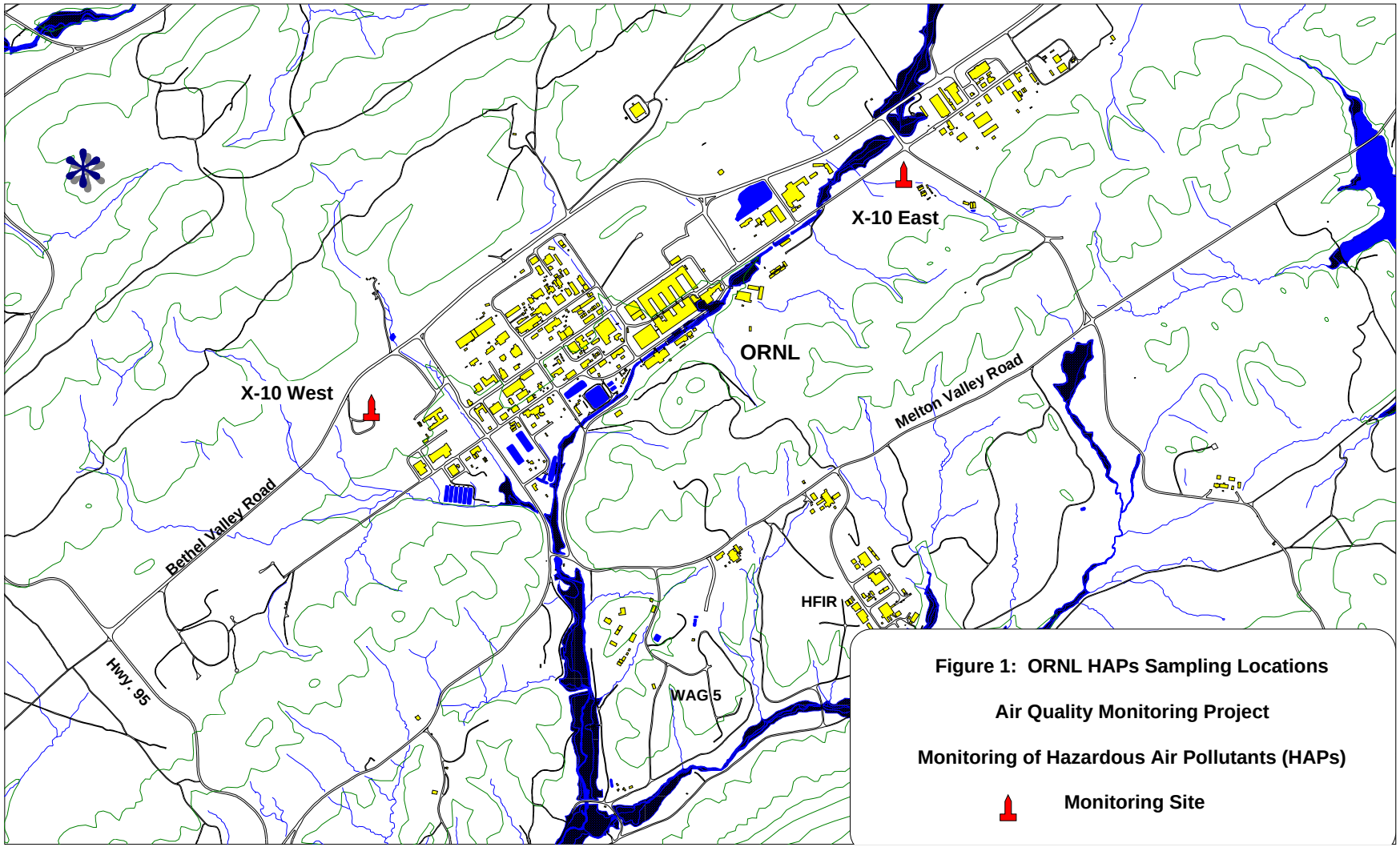
- Y-12: Y-12E - ERAMS station east of the plant entrance
  Y-12W - ERAMS station west of the plant site (See Figure 2)

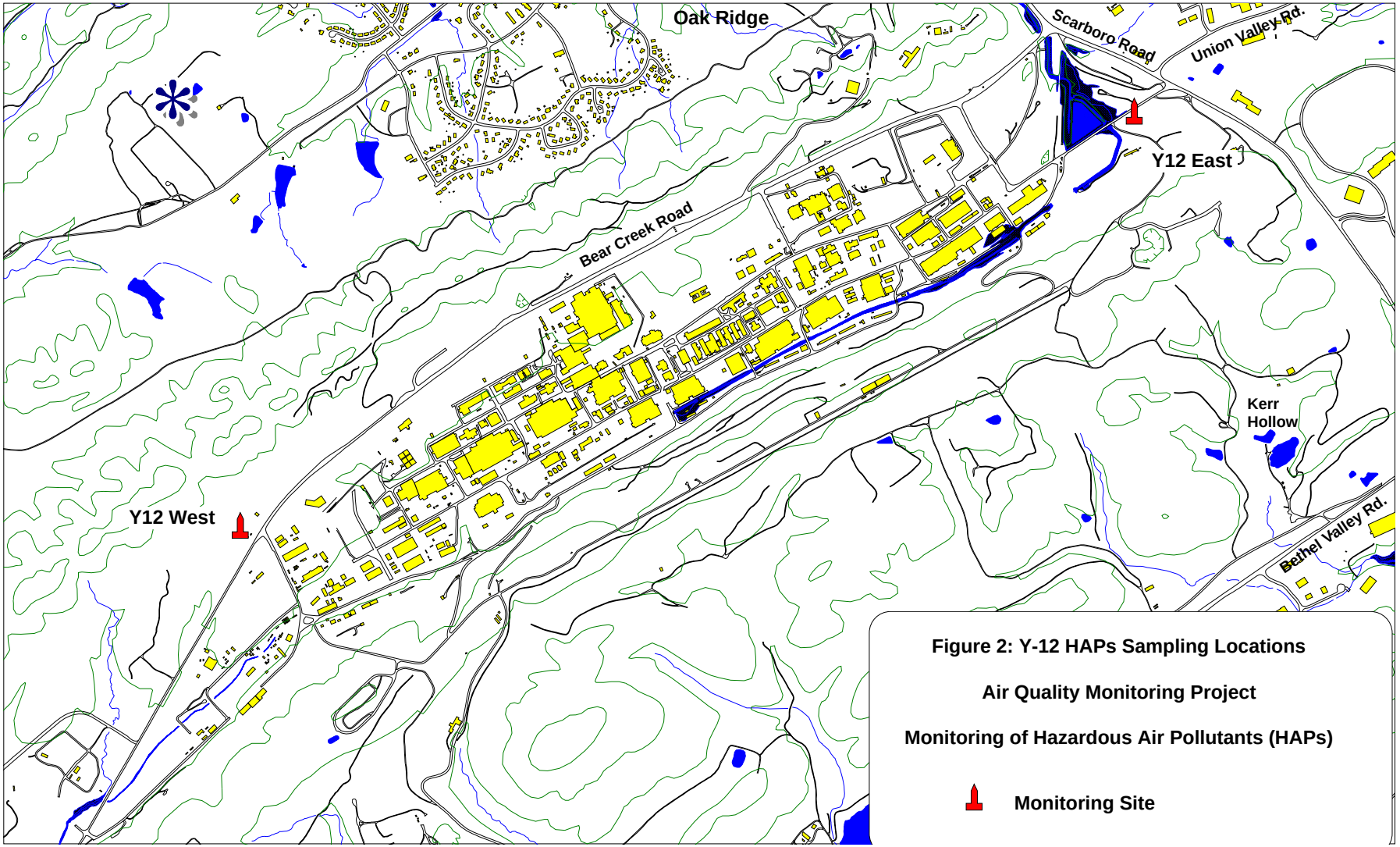
Although this project will sample for metals only, the Radiological Monitoring Oversight (RMO) program of the Department of Energy Oversight Division (TDEC) will continue ongoing radiological ambient air monitoring on the Oak Ridge Reservation.

Methods and Materials

On a weekly basis, sample filters will be collected from samplers and sent for analysis to the state laboratory in Nashville. Samplers will remain at each site for approximately one month before being rotated to the next station. The project will proceed as close as possible in accordance with the following 2005 schedule for station rotation:

January 2005	-	X-10W & Y-12W	July 2005	-	X-10W & Y-12W
February 2005	-	X-10E& Y-12E	August 2005	-	X-10E & Y-12E
March 2005	-	X-10W & Y-12W	September 2005	-	X-10W & Y-12W
April 2005	-	X-10E & Y-12E	October 2005	-	X-10E & Y-12E
May 2005	-	X-10W & Y-12W	November 2005	-	X-10W & Y-12W
June 2005	-	X-10E & Y-12E	December 2005	-	X-10E & Y-12[E]


X-10 East
ORNL
X-10 West
Melton Valley Road
Bethel Valley Road
HFIR
Hwy. 95
WAG 5
Figure 1: ORNL HAPs Sampling Locations
Air Quality Monitoring Project
Monitoring of Hazardous Air Pollutants (HAPs)
Monitoring Site


Oak Ridge
Scarboro Road
Union Valley Rd.
Y12 East
Bear Creek Road
Kerr
Hollow
Y12 West
Bethel Valley Rd.
Figure 2: Y-12 HAPs Sampling Locations
Air Quality Monitoring Project
Monitoring of Hazardous Air Pollutants (HAPs)
Monitoring Site

Power supply at the X10E site is provided via a temperature sensitive source. Therefore, during the coldest months, the ORNL sampler will be located at the X10W site. In order to balance time at each location, the ORNL sampler will be located for an extended period of time at the X10E site prior to, and after, this period. Methods and protocols have been developed based on equipment maintenance manuals supplied by the manufacturer and sampling criteria tailored specifically to this project and DOE-O's mission and staffing levels. Each sampler is mounted on a small trailer and requires leveling, and the fastening of a security chain when relocated after completion of a sampling cycle.

During each site visit, the sampler motor will be disassembled and the motor's brushes inspected for condition and evaluated for longevity. When it is not expected that the brushes will last until the next site visit, they will be replaced. The sampler will also be inspected to ensure that the orifice remains level and parallel to the ground. At each site visit the sampling cartridge will be removed and replaced with one holding a new filter. The cartridge will be covered both top and bottom, and the sample will be removed at the DOE-O laboratory and placed in a zip-lock bag. The 24-hour chart recording pressure differential will be removed and replaced weekly, and its' pen trace will be evaluated for average readings for the weekly period. Relevant information will be recorded on the reverse side of the chart. Readings of atmospheric pressure and ambient temperature are to be recorded on the chart, and the reading of the elapsed time indicator will also be taken. Proper chain of custody for samples will be maintained. DOE-O staff will maintain a quarterly calibration schedule that will be carried out in accordance with the manufacturer's specifications.

A report will be generated detailing the analytical results from each sampling location. Upon completion of the project, a final report will be prepared presenting conclusions regarding ambient air HAPs metals.

Materials required for this project include:

1. Hi-Volume sampler
2. Trailer
3. Level
4. Extension cords
5. Tool kit
6. Motor brushes
7. Filters
8. Calibration kit
9. Flow charts
10. Waterproof marking pens
11. Project data/custody forms
12. Plastic sample bags

References

New York State Department of Environment Control, Draft New York State Air Guide-1. G*uidelines for the Control of Toxic Ambient Air Contaminants, Appendix B of Air Guide-1, Ambient Air Quality Impact Screening Analyses.* 1994 Edition.

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Title 40 CFR Part 266 Appendix V.Boiler and Industrial Furnace Regulations.

Yard, C.R., 2004. *Health, Safety and Security Plan,* Tennessee Department of Environment and Conservation Department of Energy Oversight Division, Oak Ridge.

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CHAPTER 1 AIR QUALITY MONITORING

Environmental Radiation Ambient Monitoring System (ERAMS) Air Program

Introduction

In the past, air emissions as a consequence of Department of Energy (DOE) activities on the Oak Ridge Reservation (ORR) have been believed to be a potential cause of illnesses affecting area residents. While these emissions have substantially decreased over the years with the decommissioning of various processes, concerns have remained that air emissions from current activities may pose a threat to the health of the public and/or the surrounding environment. As a consequence of the above, the Tennessee Department of Environment and Conservation DOE Oversight Division (the division) will continue three air monitoring programs developed to assess the impact of ORR air emissions on the surrounding environment and the effectiveness of DOE controls and monitoring systems.

The division's Perimeter and Fugitive Air Monitoring Programs (described in associated plans) will focus on monitoring at exit pathways, non-point sources of emissions, and sites of special interest (e.g., remedial sites). Division participation in EPA's Environmental Radiation Ambient Monitoring System (ERAMS) will supplement these programs and provide verification of state and DOE monitoring, via independent third party analysis.

Methods and Materials

The five ERAMS air monitors will use synthetic fiber filters (ten centimeters in diameter) to collect airborne particulate moving through the units at a rate of approximately 35 CFM. The monitors will be operated continuously and the filters will be changed twice weekly (Monday and Thursday) by division staff. As prescribed in *Environmental Radiation Ambient Monitoring System (ERAMS) Manual* (U.S. EPA, 1988), the quantity of radioactivity on each filter will be estimated by staff using one of the division's Geiger-Mueller radiation detectors. The filters will then be mailed to EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama for analysis. ERAMS analytical parameters and frequencies are provided in Table 1.

Table 1: EPA Analysis of Air Samples Taken in Association with the Environmental Radiation Ambient Monitoring System

ANALYSIS	FREQUENCY
Gross Beta	Each of twice weekly samples
Gamma Scan	Samples having > 1 pCi/m^3 of gross beta
Plutonium-238, Plutonium-239, Plutonium-240, Uranium-234, Uranium-235, Uranium-238	Semiannually on composite air particulate filters

The approximate locations of the five ERAMS air-monitoring stations are depicted in Figure 1.

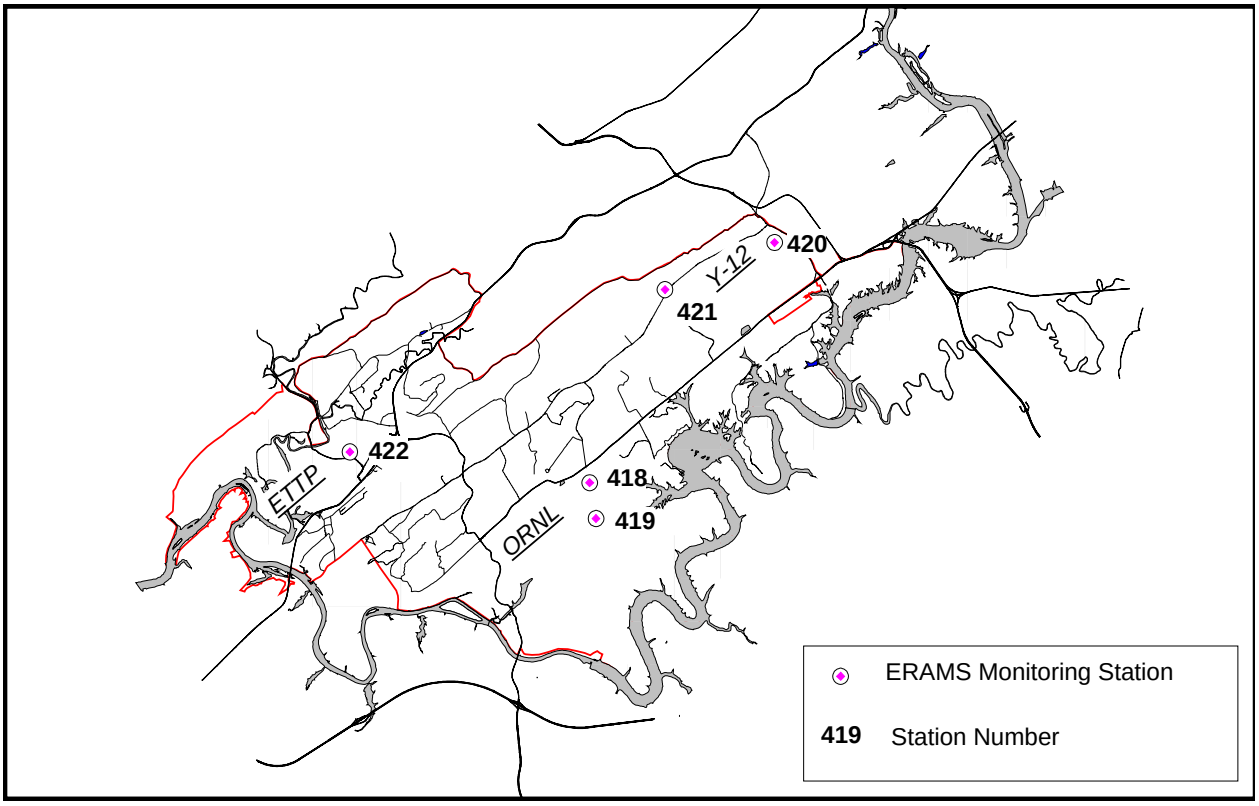

Figure 1: Approximate Locations of Air Stations Monitored in Association with EPA's Environmental Radiation Ambient Monitoring System (ERAMS) on the Oak Ridge Reservation

References

Tennessee Department of Environment and Conservation. 2001 .*Tennessee Oversight Agreement, Agreement between the U.S. Department of Energy and the State of Tennessee.* Oak Ridge, Tennessee.

U.S. EPA. 1988. *Environmental Radiation Ambient Monitoring System (ERAMS) Manual.* EPA 520/5-84-007, 008, 009. May, 1988.

U.S. EPA. 1994. *Environmental Radiation Data Report 80.* EPA-402-R-97-004. February, 1997.

Yard, C.R., 2004. *Health, Safety, and Security Plan.* Tennessee Department of Environment and Conservation, DOE-Oversight Division. Oak Ridge, Tennessee.

CHAPTER 1 AIR QUALITY MONITORING

Fugitive Radiological Emission Monitoring

Introduction

The Tennessee Department of Environment and Conservation DOE Oversight Division (the division), with the cooperation of the Department of Energy and its contractors, will conduct monitoring for fugitive radioactive air emissions on and in the vicinity of the Oak Ridge Reservation. This program will use portable high volume air monitors to supplement air sampling performed at fixed locations. The high volume monitors, along with more frequent sampling and analysis, will provide greater measurement sensitivity and resolution than can be achieved with the monitors used in the division's Perimeter Air Program. Monitoring performed with the portable units will primarily focus on nonpoint sources of air emissions and sites of special interest.

Methods and Materials

In 2005, the division will use three high volume air monitors in the program. One of these monitors will be stationed at Fort Loudoun Dam in Loudon County to collect background data. The other two units will be located at the areas of interest. Each of the monitors will use 8x10 inch glass fiber filters to collect particulates as air moves through the systems at a rate of approximately 35 CFM. Components of the monitors used to measure airflow through the filters will be calibrated quarterly using a Graseby General Metal Works Variable Resistance Calibration Kit (#G2835). Air filters from the units will be collected weekly and shipped to the state's radiochemical laboratory in Nashville, Tennessee, for analysis. Analysis will include gross alpha, gross beta, and gamma spectrometry with additional analysis performed where merited. To assess the concentrations measured, results from the portable monitors will be compared with the background data and standards provided in the Clean Air Act.

Monitoring in the program will be directed toward locations where there is a potential for the release of fugitive/diffuse emissions and sites of special interest. Likely monitoring stations for the year 2005 include the decontamination and decommissioning (D&D) of the K-25 Building at ETTP and the Environmental Management Waste Management Facility in Bear Creek Valley at Y-12. Other sites under consideration include facilities being renovated as part of the revitalization initiative at ORNL, Y12 D&D activities, and a location near the construction of the Spallation Neutron Source Facility.

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CHAPTER 1 AIR QUALITY MONITORING

Oak Ridge Reservation Perimeter Ambient Air Monitoring Program

Introduction

The Tennessee Department of Environment and Conservation, DOE Oversight Division (the division) with the cooperation of DOE will provide radiochemical analysis of air samples taken from twelve low volume air monitors located on and in the vicinity of the Oak Ridge Reservation (ORR). Data derived from the program, along with information generated by the other division air monitoring programs, will be used to: (1) assess the impact of DOE activities on the public health and environment, (2) identify and characterize unplanned releases, (3) establish trends in air quality, and (4) verify data generated by DOE and its contractors.

Methods and Materials

The twelve air monitors that will be used in the program are owned by DOE and DOE contractors are responsible for their maintenance and calibration. Nine of the units are a component of DOE's ORR perimeter air monitoring system. The remaining three monitors were previously used by the Y-12 complex in their perimeter air monitoring program.

Each of the monitors use forty-seven millimeter borosilicate glass fiber filters to collect particulates as air is pulled through the units. The ORR perimeter monitors employ a pump and flow controller to maintain airflow through the filters at approximately two standard cubic feet per minute. The Y-12 monitors use a pump and rotometer and are set to average approximately two standard cubic feet per minute.

Air filters from the monitors will be collected biweekly and sent by certified mail to the state's radiochemical laboratory in Nashville, Tennessee for analysis. Analysis will include gross alpha and gross beta on the biweekly samples. Gamma spectrometry will be performed on samples that exhibit elevated gross results and annually on composite samples.

The twelve air monitoring stations in the program are listed in Table 1. Eleven of these stations are located around the perimeter of the ORR and Y-12 facility. The twelfth site is the background station located near Fort Loudoun Dam in Loudon County.

Table 1: Perimeter Air Monitoring Stations.

Station	Location	County
4	Y-12 Perimeter near portal 2	Anderson
5	Y-12 Perimeter near Building 9212	Anderson
8	Y-12 Perimeter west end	Anderson
35	East Tennessee Technology Park	Roane
37	Bear Creek at Y-12	Roane
38	Westwood Community	Roane
39	Cesium Fields at Oak Ridge National Laboratory	Roane
40	Y-12 East	Anderson
42	East Tennessee Technology Park off Blair Road	Roane
46	Scarboro Community	Anderson
48	Deer Check Station on Bethel Valley Road	Anderson
52	Fort Loudoun Dam (Background Station)	Loudon

Figure 1 depicts the approximate locations of the monitoring stations.

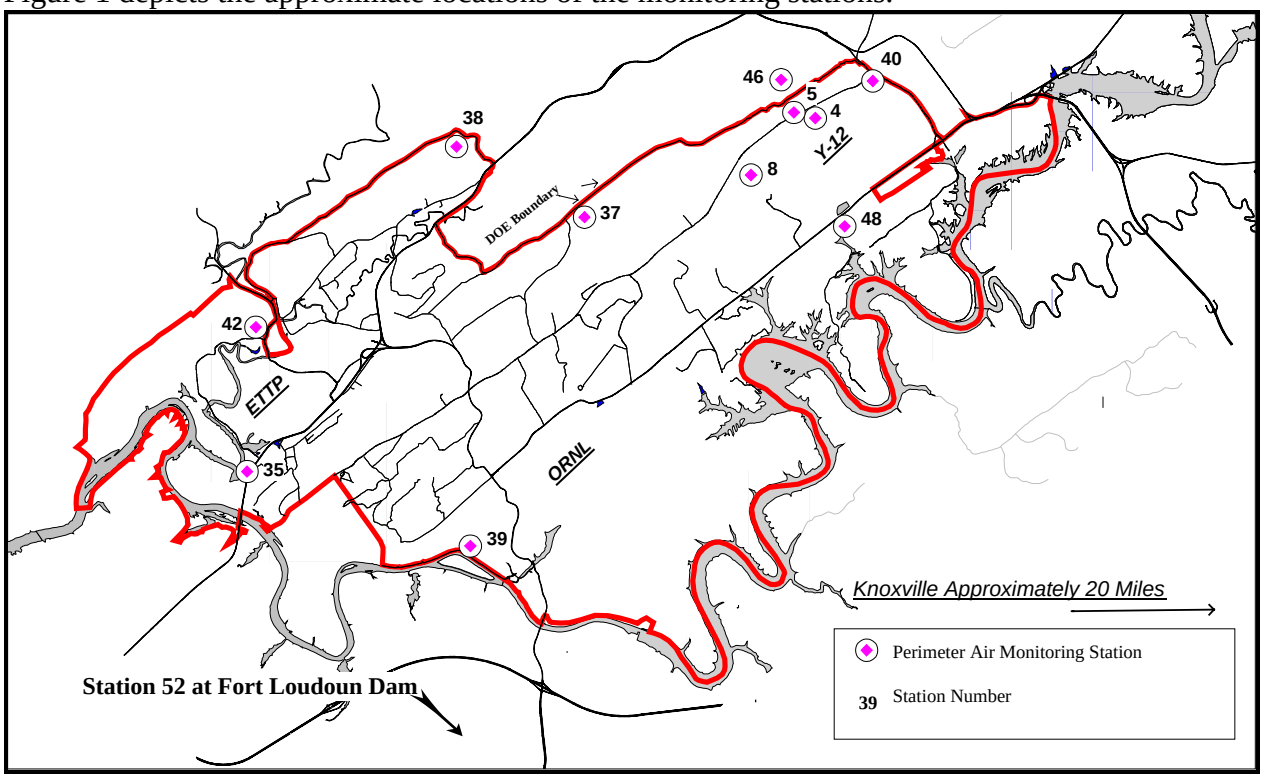

Figure 1: Approximate Location of Oak Ridge Reservation and Y-12 Perimeter Air Monitoring Stations

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Tennessee Department of Environment and Conservation. 2001. *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee*. Oak Ridge, Tennessee.

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CHAPTER 2 BIOLOGICAL/FISH AND WILDLIFE

Benthic Macroinvertebrate Biomonitoring Using a Semi-Quantitative Approach: Rapid Bioassessment Protocol (RBP III)

Project Description

The objective of this monitoring program is to perform biological monitoring on streams effected by activities and practices on the Oak Ridge Reservation (ORR) using methods outlined in the *State of Tennessee Department of Environment and Conservation (TDEC) Division of Water Pollution Control (WPC) Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys* (March 2002, Revised November 2003).

Introduction

Because benthic macroinvertebrates are relatively sedentary and long lived, they are excellent indicators of the "overall health" of an aquatic system. In systems where the source of the toxicant is non-point (e.g. runoff or seeps) or where the combined effects of pollutants in a complex effluent exceed individual toxicity (synergism), benthic macroinvertebrate communities may be one of the only means of evaluation.

Benthic macroinvertebrates are collected on various ORR streams and analyzed to independently assess the "overall health" of the aquatic environments and to measure the degree of impact from past and present DOE operations. The division conducts annual semi-quantitative RBP III biomonitoring on the following ORR streams: Bear Creek, Mitchell Branch, White Oak Creek, Melton Branch, and East Fork Poplar Creek. Benthic samples are also collected from Clear Creek near Norris Dam serving as an ecoregion reference site for all ORR test sites. In addition, three (3) new sites will be selected and sampled for qualitative purposes. These samples will be processed in-house at no cost.

Surface water samples will be collected semi-annually at all sites and will compliment the macroinvertebrate sampling. Water samples will be transported to the Tennessee state laboratory in Knoxville and analyzed for bacteria, nitrates, hardness, metals, mercury, and radionuclide constituents. Sulfates will also be analyzed in East Fork Poplar Creek and Hinds Creek. EPA approved methods will be used for the collection of the water samples. All work associated with this program will be in compliance with the division's Health, Safety, and Security Plan.

Methods and Materials

Benthic macroinvertebrate samples will be collected and processed following TDEC Water Pollution Control (WPC) standard operating procedures (SOP). Briefly, samples will be collected from two riffles at each site with the use of a kick net. Both samples will be composited and transferred into one sample container. The container will be labeled internally and externally with site-specific information and stored in the TDEC DOE-O laboratory for future processing. Standard methods will be altered when sampling lower White Oak Creek due to the presence of radioactive contamination in the stream sediment. The two kick samples will be combined in a five-gallon bucket, creek water is added and the sample swirled to suspend the lighter material (invertebrates). The elutriate will then be poured through a sieve. This process will be repeated five times collecting the majority of organisms. Any material not used will be returned to the creek. Detailed sampling procedures can be obtained by referring to the TDEC WPC SOP.

Once collections have occurred at all sites the semi-quantitative samples will be transported to the State laboratory in Nashville for processing. Laboratory sample analysis will include the identification and enumeration of the benthic macroinvertebrates and data reduction. Using the raw benthic data from the semi-quantitative subsamples, a numerical value will be generated for seven biometrics. These metrics include (1) EPT (Ephemeroptera, Plecoptera, and Trichoptera) Richness, (2) Taxa Richness, (3) Percent OC (oligochaetes and chironomids), (4) Percent EPT (EPT abundance), (5) NCBI (North Carolina Biotic Index), (6) Percent Dominant (Percent contribution of the single most dominant taxon), and (7) Percent Clingers (Percent contribution of organisms that build fixed retreats or have adaptations to attach to surfaces in flowing waters). After values have been calculated for the metrics, a score of 0, 2, 4, or 6 is assigned to each metric based on comparison to the ecoregion reference database. The seven scores are totaled and the site's biological condition is determined. Metric equations and the biocriteria used to determine biological condition can be obtained by referring to the TDEC WPC SOP.

Schedule and sampling locations in kilometers (mile equivalents) for RBP III sites:

East Fork Poplar Creek: EFK 24.4 (15.2), EFK 23.4 (14.5), EFK 13.8 (8.6), and EFK 6.3 (3.9). Reference site: Hinds Creek HCK 20.6 (12.8). All sites will be sampled within a three-day time span in April or May.

Bear Creek: BCK 12.3 (7.6) and BCK 9.6 (6.0). Reference site: Mill Branch MBK 1.6 (1.0). All sites will be sampled within a three-day time span in April or May.

Mitchell Branch Creek: MIK 0.71 (0.44) and MIK 0.45 (0.28). Reference sites: MIK 1.43 (0.89). All sites will be sampled within a three-day time span in April or May.

White Oak Creek: WCK 2.3 (1.4), WCK 3.4 (2.1), and WCK 3.9 (2.4). Reference site: WCK 6.8 (4.2). All sites will be sampled within a three-day time span in April or May.

Melton Branch: MEK 0.3 (0.2)

Clear Creek: CCK 1.45 (ecoregion reference site). This site will be sampled in April or May.

References

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CHAPTER 2 BIOLOGICAL/FISH AND WILDLIFE

Fish Tissue Monitoring Plan

Introduction

The Tennessee Department of Environment and Conservation (TDEC) posts warning signs on streams or lakes in which public health is endangered. In Tennessee, the most common reasons for a river or lake to be posted are the presence of sewage bacteria or other contaminants in the water, sediment, or fish of a waterbody.

When fish tissue samples show levels of a contaminant higher than established criteria, the waterbody is posted and the public is advised of the danger. If needed, TWRA can enforce a fishing ban. Approximately 84,100 lake acres and 142 river miles across the state are currently posted due to contaminated fish. When the department issues new advisories, signs are placed at significant public access points and a press release is submitted to local newspapers. Table 1 shows current criteria used for issuing fish consumption advisories in Tennessee.

Table 1. State of Tennessee fish tissue advisory criteria

Contaminant	Level (ppm)
PCBs	1.00
Hg	0.50

The annual fish tissue meeting is held each year to exchange data and coordinate sampling efforts among the many organizations that sample fish tissue in Tennessee. The 2004 meeting focused primarily on efforts around the Oak Ridge Reservation (ORR). Review of PCB levels in catfish on Watts Bar Reservoir indicates that these levels have continued to decline over the past several years. Table 2 shows current posting on Watts Bar Reservoir. None of the collecting agencies currently have funds available to analyze these samples. This will be a multi-agency effort with TVA and ORNL conducting the sampling, TDEC DOE-O conducting the analysis, and TDEC WPC evaluating the results.

Table 2. Current Fish Advisory Postings on Watts Bar Reservoir

Reservoir	Portion	Pollutant	Species
Watts Bar	Tennessee River arm	PCBs	Catfish, striped bass, & hybrid (striped bass-white bass) should not be eaten. Precautionary advisory for white bass, sauger, carp, smallmouth buffalo, and largemouth bass.
Watts Bar	Clinch River arm	PCBs	Striped bass should not be eaten, Precautionary advisory for catfish and sauger.

Methods and Materials

Fish samples will be collected by various agencies during the course of their normal collection activities. Table 3 lists species that will be collected and the sites from which they will be collected. Preparation of samples will be done by collecting agencies with samples being submitted by TDEC DOE-O to the State laboratory for analysis. Samples will consist of a homogenized five fish composite for each site and species. Analyses for PCBs and mercury will be conducted on each sample.

Table 3. Watts Bar Reservoir Fish Tissue Collections

Site	Location	Species to be Collected							
Forebay	TRM 531	C. Catfish	LMB	Sauger	Sm. Buffalo	Striped bass	Hybrid bass	White bass	Carp
Mid-Res	TRM 560.8	C. Catfish	LMB	Sauger	Sm. Buffalo	Striped bass	Hybrid bass	White bass	Carp
TN Inflow	TRM 600	C. Catfish	LMB	Sauger	Sm. Buffalo	Striped bass	Hybrid bass	White bass	Carp
CL Inflow	CRM 19	C. Catfish	LMB	Sauger		Striped bass			

C. Catfish = Channel Catfish
LMB = Largemouth Bass
Sm. Buffalo = Smallmouth Buffalo
Hybrid bass = Striped bass X White bass Hybrid

Based on this collection, there will be a total of 28 samples submitted for PCB and mercury analysis. Collection will take place during fall 2004.

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Tennessee Department of Environment and Conservation. 2001. *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee*. Oak Ridge, Tennessee.

U.S. Environmental Protection Agency. 2000. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 1: Fish Sampling and Analysis. Third Edition.* U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 823-B-00-007.

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CHAPTER 2 BIOLOGICAL/FISH AND WILDLIFE

Canada Geese Monitoring Plan

Introduction

A large population of Canada geese, both resident and transient, visits the Oak Ridge Reservation (ORR). While migratory geese have always visited East Tennessee, Tennessee Valley Authority (TVA) and Tennessee Wildlife Resources Agency (TWRA) introduced the resident population to the Melton Hill region in 1972. Geese prefer to eat grass, but will also eat water plants including root nodules from bottom sediment. Studies in the 1980s demonstrated that geese associated with the contaminated ponds/lakes on the ORR can accumulate radioactive contaminants quickly and that contaminated geese frequent off site locations. The thriving goose population in this area makes this animal an easily accessible food for area residents. Although hunters are offered the opportunity for a radiological screening of their kills, not many take advantage of this service (TWRA, personnel communication). Results of Tennessee Department of Environment and Conservation Department of Energy Oversight Division (the division) off-site sampling in 1999 showed no elevated levels of radioactivity in the geese sampled. Similarly, all geese captured during the Department of Energy (DOE) 1999, 2000, and 2001 "goose roundup" were below the 5 pCi/g game confiscation level, which DOE Oak Ridge has set as an administrative guideline. During the 2002 "goose roundup," three geese were captured from ONRL that had Cs-137 levels above the 5 pCi/g game confiscation level. Geese subsequently captured in offsite sampling at the Oak Ridge Marina showed no Cs-137 or other contamination above the confiscation level. During the 2004 "goose roundup," all geese sampled were below the 5 pCi/g game confiscation level.

Geese with elevated levels of Cs-137 in muscle tissue have been found primarily in areas near ORNL. A study in September 1998 found elevated levels of Cs-137 in grass and sediment at two reaches of White Oak Creek south of 3513 Pond and in grass around the 3524 pond. Sediment in and around White Oak Lake (WOL) and White Oak Creek has elevated levels of Cs-137. Canada geese have been observed on WOL and throughout the ORNL area. After a flock of radioactive geese was found at ORNL in 1998, DOE took several measures to discourage the geese from using and feeding in contaminated areas. Flagging and fencing were improved and several areas were defoliated. These measures appear to have been successful, with no significantly contaminated geese being captured on or off the reservation in 1999 through 2001. State geese sampling would only take place, if any of the geese captured in the Year 2005 DOE "goose roundup" showed significantly elevated levels of radioactivity (above 5 pCi/g). This would indicate the possibility of radioactively contaminated geese leaving the reservation.

Methods and Materials

During the week preceding the goose roundup, areas around the perimeters of the ORR will be scouted to identify locations of possible populations of geese. This will facilitate activities on the day of collection by predetermining likely locations to sample.

Sampling would take place immediately after the annual *ORR Goose Roundup* with equipment and assistance from TWRA and ORNL. Geese are molting at this time of year and are nearly flightless. Sampling would take place over a one to two day period. Variables such as flock location and ease of capture will affect the schedule.

The site selected should be near contaminated vegetation, water, and sediment. An optimum site is the Jones Island area in Loudon County. Geese from this area have access to White Oak Lake and other contaminated ORNL sites. Due to recent movements of populations, the most likely locations will be the Oak Ridge Marina and the Solway Park areas.

Geese would be captured using the same technique as the DOE goose roundup. Eight to fifteen people would slowly converge on a flock of geese forcing them into a temporary enclosure consisting of chicken wire and reinforcing bar. At least 15 individual geese would be captured to assure accuracy of the reading and a representative sample of the flock. Geese would be transported in cages to the TWRA check station for weighing, sexing, and a whole body count. All activities would be carried out in compliance with the division's Health, Safety, and Security Plan (2004).

Results of the whole body count would determine the necessity for further analysis of the geese. If the whole body counts showed the radioactive contamination of the geese to be 5 pCi/g or greater, muscle tissue from the contaminated geese will be radiologically analyzed to confirm the results of the whole body counts and to determine if other contaminants are present. Additional analyses would be for cesium-137, mercury, cadmium, selenium, and lead in the breast and/or leg tissue of geese with whole body counts above 5 pCi/g. Up to six geese (two high, two medium, and two low whole body counts) would be analyzed from a contaminated flock.

Most material will be provided by TWRA. This includes:

- Fencing
- Cages
- Tags

The whole body counters are the property of ORNL and would be operated by their personnel.

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Chapter 2 BIOLOGICAL/FISH AND WILDLIFE

Monitoring and Sampling of Aquatic and Terrestrial Plants in Surface Water and Ecological Habitats on the ORR

Introduction

The gathering of collateral information in support of the division's groundwater monitoring and sampling efforts of springs and surface water will be a priority of this project. If surface water bodies (i.e., springs, ponds) have been impacted by hazardous substances, it is likely that the aquatic plant organisms in the immediate vicinity could be uptaking radionuclides or other hazardous substances. The focus of this plan/program will be the detection and characterization of hazardous substances bioaccumulated by both aquatic and terrestrial vegetation to determine ecological and human health risk factors.

Target vegetation examples for sampling will include (but not be limited to): 1) watercress; 2) green algae (*Ulothrix, Spirogyra, Oedogonium*, etc.); 3) periphyton (benthic algae -see discussion below); 4) mosses (Bryophyta); 5) liverworts (Hepatophyta); 6) horsetail and quillworts (*Equisetum and Isoetes*); 7) floating & attached aquatic plants (*Azolla, Lemna, Wolffia, Salvinia*); 8) club moss (*Huperzia sp*.); and 9) lichens (*Cladina sp.* and *Cladonia sp.)*. These plant species have been selected because they are excellent bioindicators. These plants are remarkably sensitive to pollution, radioactive fallout, and other hazardous substances (pathogens, i.e., chemicals, metals, etc.). These plants are known to be ingested by aquatic organisms and herbivores.

Watercress, a floating, rooted, aquatic plant (angiosperm) has been selected for its affinity to thrive around its natural habitat, in clear slow-moving water near the mouth of springs. If the spring water is impacted, then aquatic plant species are likely to have absorbed some of the hazardous substances.

Green algae and "periphyton" occur in most of the aqueous environments within ORR watersheds (Upper East Fork Poplar Creek). Periphyton is a term used to describe communities of microorganisms that are attached to various aquatic substrates and grow as thick gelatinous mats of mixed assemblages including green algae, cyanobacteria, fungi, associated macrophytes (e.g., cattails, duckweed, water spangles, etc.), invertebrate grazers (e.g., snails), and detritus. Periphyton biomass produces much of the low end of the food chain for many aquatic organisms and herbivores. They are sensitive indicators of environmental physiochemical change and bioaccumulation of hazardous substances.

Prospective habitats both on and off-site of the ORR such as springs, seeps, karst features, streams, wetlands, impoundments (ponds), landfills, creek embankments, rock outcrops, state Natural Areas, and other terrestrial ecosystems will receive priority as potential sampling and monitoring sites (see Figures 1 and 2). Watersheds such as Bear Creek and its tributaries, White Oak Creek/Lake and its tributaries, and Mitchell Branch are all probable target habitats for sampling.

Figure 1: Potential Aquatic Plant Sampling Locations - East Half of ORR

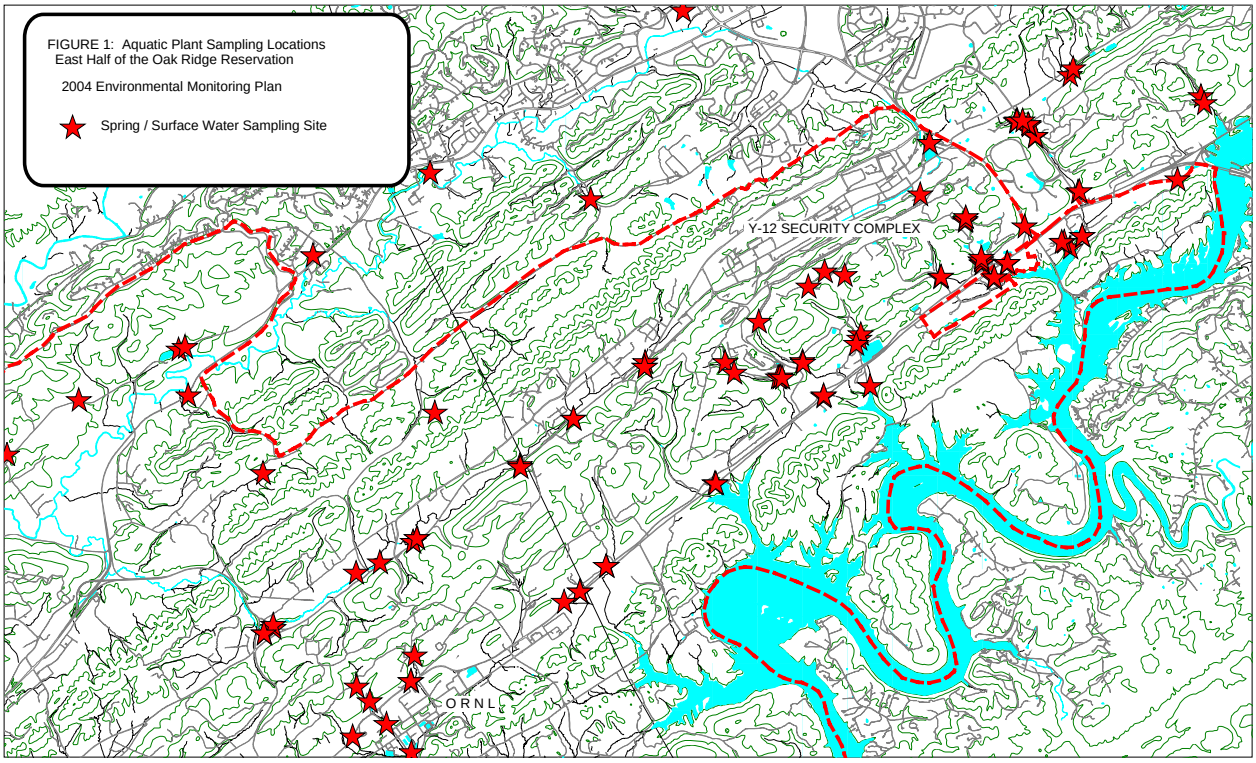
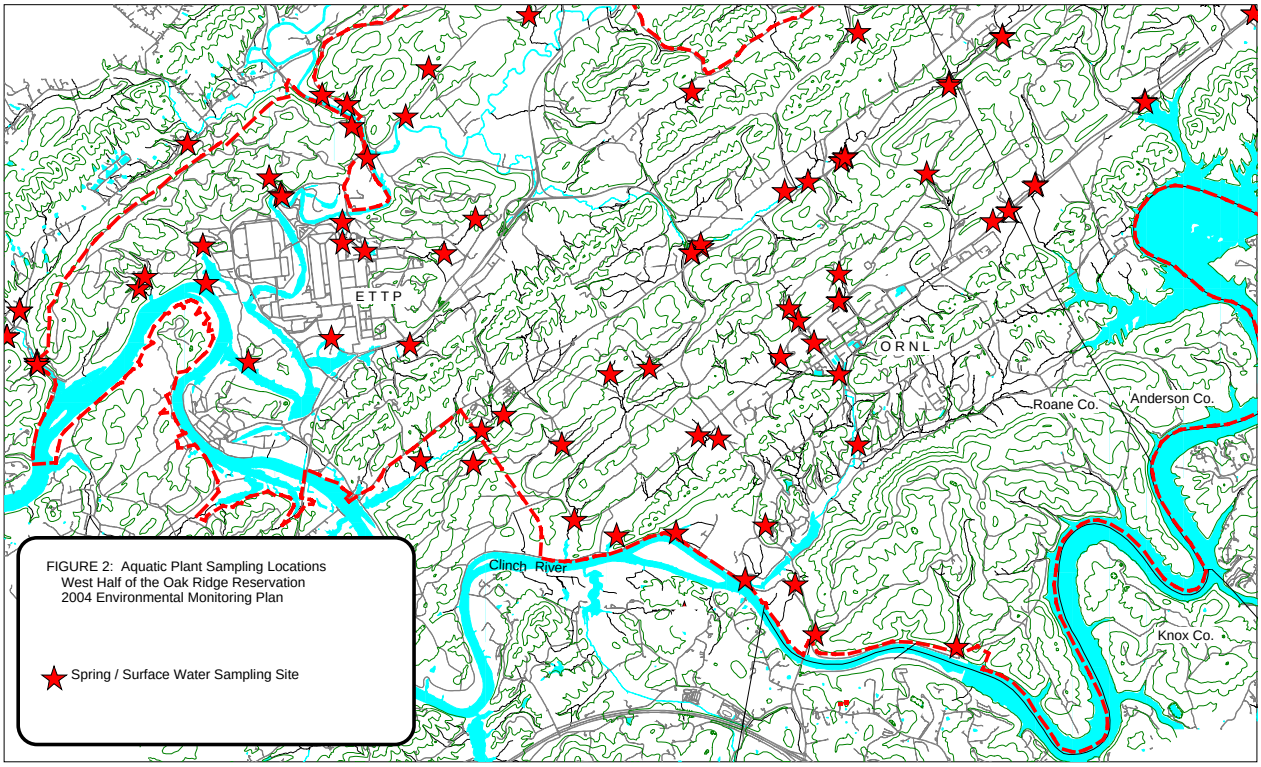


Figure 2: Potential Aquatic Plant Sampling Locations – West Half of ORR



The first two sampling seasons (2002-03) involved the sampling and analysis of watercress, algae, and aquatic vegetation. For 2004 the project broadened in scope to include determinations of the ecological implications of these findings. For 2005, the focus will be to compare numbers from previous sampling and evaluate for further exit pathways.

Methods and Materials

Field samples will be collected at predetermined habitats and ecosystems both on the ORR and offsite (for background data). Plastic ziplock baggies and plastic (jar-like) containers will be used for collection of samples in the field. Rubber/plastic gloves will be worn during sampling activities. Each sampling location will be assigned an identification number (established spring names will be used for watercress samples) and mapped using global positioning system (GPS) technology. Rock substrate or Plexiglas plates will be used to sample the periphyton (diatoms).

Arrangements will be made in advance with appropriate Tennessee Oversight Agreement site coordinators for ingress/egress to radiological areas, to obtain Radiation Worker Permits, if necessary and for the presence of health physics technicians on an as needed basis. All samples will be screened radiologically in the field prior to returning to the division's office. Using radiological counting equipment available in the division laboratory, exposure rates (dose) will be calculated from selected field samples to determine exposure, absorbed dose, etc. Periphyton (diatoms) will be identified using available TDEC microscopes and lab manuals (ORNL lab space & microscope equipment is available for taxonomy purposes upon request).

Samples collected will be shipped to the state Environmental Laboratory in Nashville for analysis of metals, gross alpha-beta and gross gamma parameters. The sampling and analysis plan this year will focus on areas on the Reservation where elevated levels were encountered on the preliminary (previous) samples.

Target radionuclides being somewhat mobile and occurring in the ORR environment as contamination include (but are not limited to):

(1) Cesium-137
(2) Strontium-90
(3) Cobalt-60
(4) Uranium isotopes and daughter products
(5) Technetium-99

Metals of interest will include:

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium

- Mercury
- Nickel
- Selenium
- zinc

Sampling protocol and quality control methods will follow the guidelines in the division's "Standard Operating Procedures" and the "Health, Safety, and Security Plan." Field techniques and laboratory methods will follow standard ASTM, EPA, and FRMAC methodology, sampling, and operating procedures. Standard Operating Procedures for the project include (but not limited to):

(1) ASTM Guidelines:

ASTM Volume 11.02 – Organic Constituents/Radioactivity/Microbiological
ASTM Volume 11.05 – Biological Effects & Environmental Fate/Biotechnology
ASTM Volume 12.02 – Nuclear/Solar/Geothermal/Dosimetry/Radiation Effects

(2) Federal Manual for Sample Processing and Analysis Manual (FRMAC) – 1996:

Vol. 1 – Radiation Monitoring & Sampling - Field Sampling: Vegetation/Fruit Sampling, Supplies and Procedure

Vol. 2 - Sample Preparation and Analysis – Method 6: Preparation of FRMAC Field Samples

Vol. 2 - Sample Preparation and Analysis – Method 7: Gamma Emitting Radionuclides in FRMAC Samples

(3) U.S.G.S. Methods for Collection and Analysis of Aquatic Biological & Microbiological Samples: Book 5, Chapter A4

(4) U. S. Army Corps of Engineers: Wetlands Delineation Manual

(5) U. S. EPA Standard Operating Procedure – Ash Free Dry Basis – Periphyton

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Chapter 2 BIOLOGICAL FISH AND WILDLIFE

Plant Surveys (Field Botany)

Introduction

Vascular plant field surveys on portions of the Oak Ridge Reservation (ORR) were initiated during mid-2003 by division staff. For example, both rare (threatened & endangered species, i.e., "T & E species") and invasive (exotic or non-native) plants were mapped on the Blackoak Ridge (proposed) conservation easement parcel (to date have covered about 40 percent of 3000 acres). Much field reconnaissance work remains to be completed in 2005 on this and other areas of the ORR, i.e., land parcels to be released by DOE, various road-widening and construction projects, etc. Additional botanical projects that will be continued during 2005 include sampling, monitoring and taxonomy of photosynthetic protists (non-vascular aquatics) as oversight of the ORNL biological monitoring and abatement program's (BMAP) toxicity and bioaccumulation assessment of periphyton in East Fork Poplar Creek.

Major functions and focus of the project include: (1) provide oversight support and botanical expertise locally to the TDEC Division of Natural Heritage as needed relating to ORR issues, especially T & E species. (2) inventory and map the biological diversity that exists on the ORR to provide floristics survey information about the ORR's plant species. (3) independently monitor and confirm biological survey and sampling information provided by DOE. (4) protect plants and natural communities (including natural areas) that represent biological diversity on the ORR. (5) provide flexibility in biomonitoring the full spectrum of the plant kingdom taxa (both vascular and non-vascular plants) as recognized by the International Code of Botanical Nomenclature (ICBN). (6) provide field oversight during DOE subcontractor (and/or BMAP) vascular plant surveys on ORR projects (i.e., road construction projects, land transfers, etc.).

This project will incorporate the division's oversight role of environmental surveillance and monitoring. Additionally, several federal and state laws support this effort: (1) the federal Endangered Species Act of 1973 (ESA), as amended, provides for the inventory, listing, and protection of species in danger of becoming extinct and/or extirpated, and conservation of the habitats on which such species thrive, (2) the National Environmental Policy Act (NEPA), requires that federally-funded projects avoid or mitigate impacts to listed species, (3) the Tennessee Rare Plant Protection and Conservation Act of 1985 (Tennessee Code Annotated Title 11-26, Sects. 201-214), provides for a biodiversity inventory and establishes the State list of endangered, threatened, and special concern taxa, (4) National Resource Damage Assessments (NRDA) as directed by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by SARA (Superfund Amendments and Reauthorization Act of 1986), relating to damages to natural resources on the ORR.

Methods and Materials

Field mapping of native and invasive plant species will utilize field stations (50 foot diameter mini-plots) at pre-selected intervals (i.e., grid patterns, traverses, etc.) based on specific reconnaissance projects. Unusual or rare plants will be located and mapped, if found between these intervals. Sometimes, spot locations of plant taxa may be recorded while on water or sediment sampling field

trips. Generally, field biodiversity inventories will begin with existing roads and trails, then transects will be walked cross-country (similar to a "timber cruise") in generally north-south, east-west traverses to complete a grid pattern of coverage over the parcel. Habitats such as small drainage ravines, floodplains, wetlands, watersheds, sub-watersheds, sinkholes, cedar barrens, rock outcroppings, cliffs, springs, caves, etc. will be field surveyed for plant taxa. Field surveys are designed to locate and identify T & E plant species, invasive plant species, aquatic and wetland taxa (including algae).

Each field station (mini-plot) will be mapped and located using a Global Positioning System (GPS) hand-held field unit (Garmin™). Each field station will be defined as a 50-foot circle from center point or circumference. Plant taxa will be organized and compartmentalized as: canopy, subcanopy, shrub, herbaceous, and groundcover layers. Digital camera images will be made at most field sites to record and document plant taxa. Microscopy images of algal taxa will be recorded with the digital camera as well. Additionally, the boundaries of the pine deadfall areas (pine-beetle devastated areas) will be mapped whenever possible in the field. These sites may become important ecological study areas to determine if native climax species or invasives will re-establish here.

No sampling of plant species for the purpose of generating analytical data (bioaccumulation data) is envisioned for this project. However, benthic algae samples may be collected from either artificial substrates or natural substrates for taxonomic and stressed community recovery determinations (for protocols refer to Patrick 1973, Porter 1993, Hawkins et al. 1998, & Barbour et al. 1998). Terrestrial plant species may be collected for preservation as herbarium specimens (vouchers). The sample will be collected as much as possible with either flower or fruit, then pressed and dried, and mounted on herbarium paper with appropriate identification labels. These are quite useful for training purposes but more importantly to properly document and confirm plant species (especially rare species) encountered in the field. Care will be taken while collecting plant specimens so as not to destroy or damage a rare plant colony.

Field data sheets (survey logs) will be recorded for each survey station and later placed in a database for inclusion in the environmental monitoring report. Maps will be prepared with MapInfo™ to illustrate locations of all field stations with plant data, geologic features and other pertinent biological habitat and field data.

Field monitoring methods and health and safety procedures will follow the guidelines in the division's *"Standard Operating Procedures"* and *"Health, Safety, and Security Plan."*

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CHAPTER 3 DRINKING WATER

Sampling of Oak Ridge Reservation Potable Water Distribution Systems

Introduction

The water distribution systems at each of the DOE ORR sites are regulated by the *Tennessee Safe Drinking Water Act* (T. C. A. 68-13-701) and the *Regulations for Public Water Systems and Drinking Water Quality* (Chapter 1200-5-1). The Tennessee Department of Environment and Conservation Department of Energy Oversight Division (the division) may conduct oversight of sampling for total coliform bacteria and free chlorine residuals at various sites throughout the potable water distribution systems on the Oak Ridge Reservation (ORR). In addition, the division may oversee ORR line-flushing practices, water main repairs, cross-connection control programs, and water-loss/leak detection activities in order to identify potential threats to the potable water supply. If potential threats are identified, then additional chemical and radiological sampling may be conducted to insure that the quality of the potable water is maintained.

The division, through a memorandum of understanding (MOU) with the TDEC Division of Water Supply (DWS), reviews chemical and bacteriological sampling results from the water systems on the ORR. Review of these sampling results combined with:

- knowledge of localized plant populations and water demand
- backflow device location
- testing and maintenance procedures
- line repairs or maintenance
- proximity of water lines, identified on site maps, to radiological or non-radiological source waters will be used as a basis for TDEC DOE-O independent sampling when evidence exists of possible shallow subsurface plume infiltration, cross connections, low chlorine residuals, or other upset conditions.

Confirmation of any detects reported can dictate additional sampling or split samples. Continued detects may justify increased monitoring for that compound.

In addition, review of Cross Connection Control Programs will be conducted to evaluate the effectiveness of such plans and the degree of protection afforded by them. This will be checked by verifying inspection dates on backflow prevention (BFP) devices, review of records of BFP devices and inspection for possible unprotected cross connections.

Methods and Materials

The following sections provide information regarding the sample processing and analytical laboratory procedures.

Free Chlorine Residual

The sample will be collected into two of the small sample containers provided with the Hach Pocket Colorimeter Kit. One of the samples will be designated as the blank sample and the other will be the actual sample to be analyzed. A DPD powder pillow is poured into the sample container and gently shaken and allowed to sit for three minutes. After three minutes, the blank is placed into the pocket colorimeter and the “zero” button is

depressed. The blank container is removed and replaced with the sample container. The "read" button is depressed and the free chlorine residual is read directly from the pocket colorimeter display.

Bacteriological

The U.S. Environmental Protection Agency (EPA) approved method for coliforms, Colilert in the pass/fail mode, will be the methodology utilized by the Tennessee Department of Health, Environmental Laboratory and Microbiology Laboratory Organization (Laboratory Services). For bacteriological testing on raw water sources, the counting application of the Colilert kits would be identified and utilized. The Lab has expertise in a broad scope of services and analysis available to the division and other TDEC divisions statewide.

Organic, Inorganic and Radiological

Analytical methods are provided in the Standard Operating Procedures (SOP) manuals for the Tennessee Laboratory Services Division. The SOPs refers to proper EPA or other methods. In order to assess methods used division staff should communicate with their sampling and analytical counterparts within the ORR on a basis that facilitates technical exchange and openness. General sampling and analysis methods are to follow EPA guidelines as listed in appropriate parts of 40 Code of Federal Regulations (CFR).

Quality Control/Quality Assurance

If independent sampling activities are conducted, care will be taken to include quality control samples. The level of quality control methodology implemented will be commensurate with the level of independent sampling. Forms of control sampling to be considered will be blanks, duplicate analysis, division split samples, or even split samples with site DOE contractor. Information pertaining to the quality control samples will be included in program files, spreadsheets, and a bound notebook similar to actual samples.

Equipment that will be required to accomplish this oversight and sampling project:

- Latex gloves
- Hach Pocket Colorimeter Kit
- Hach free chlorine DPD powder pillows
- Bound field book
- State vehicle
- Health, Safety, and Security Plan
- Sample bottles
- Sampling cooler
- Disinfectant (full strength) spray bottle

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CHAPTER 3 DRINKING WATER

Implementation of EPA's Environmental Radiation Ambient Monitoring System (ERAMS) Drinking Water Program

Introduction

Radiological contaminants released on the Oak Ridge Reservation (ORR) enter local streams and are transported to the Clinch River. While monitoring of the river and local water treatment facilities has indicated concentrations of radioactive contaminants are below regulatory criteria, there has remained a concern that ORR pollutants could impact area public water supplies. In response to these concerns, the Tennessee Department of Environment and Conservation Division of DOE Oversight (the division) began participation in EPA's Environmental Radiation Ambient Monitoring System (ERAMS) in 1996. This program provides for radiological monitoring of public water supplies near nuclear facilities throughout the United States. In this regard, the ERAMS program is designed to:

1. Monitor pathways for significant population exposure from routine and/or accidental releases of radioactivity;
2. Provide data indicating additional sampling needs or other actions required to ensure public health and environmental quality;
3. Serve as a reference for data comparison (U.S. EPA, 1988)

The ERAMS program also provides a mechanism to evaluate the impact of DOE activities on water systems located in the vicinity of the Oak Ridge Reservation and verify DOE monitoring in accord with the *Tennessee Oversight Agreement* (TDEC, 2001).

Methods and Materials

As in the past, EPA will provide radiochemical analysis of finished drinking water samples collected quarterly by division staff at five public water supplies located on and in the vicinity of the ORR. This analysis will be performed at EPA's National Air and Radiation Environmental Laboratory in Montgomery, Alabama. ERAMS analytical frequencies and parameters are provided in Table 1.

Table 1: Environmental Radiation Ambient Monitoring System Analysis for Drinking Water

ANALYSIS	FREQUENCY
Tritium	Quarterly
Gross Alpha	Annually on composite samples
Gross Beta	Annually on composite samples
Gamma Scan	Annually on composite samples
Iodine-131	Annually on one individual sample/sampling site
Radium-226	Annually on samples with gross alpha >2 pCi/L
Radium-228	On samples with Radium-226 between 3-5 pCi/L
Strontium-90	Annually on composite samples
Plutonium-238, Plutonium-239, Plutonium-240	Annually on samples with gross alpha >2 pCi/L
Uranium-234, Uranium-235, Uranium-238	Annually on samples with gross alpha >2 pCi/L

The five Oak Ridge area monitoring locations are: Kingston Water Treatment Plant, Gallaher (K-25) Water Treatment Plant, West Knox Utility, City of Oak Ridge Water Treatment Facility (formerly DOE Water Treatment Plant at Y-12), and Anderson County Utility District. Figure 1 depicts the approximate locations of raw water intakes associated with these facilities.

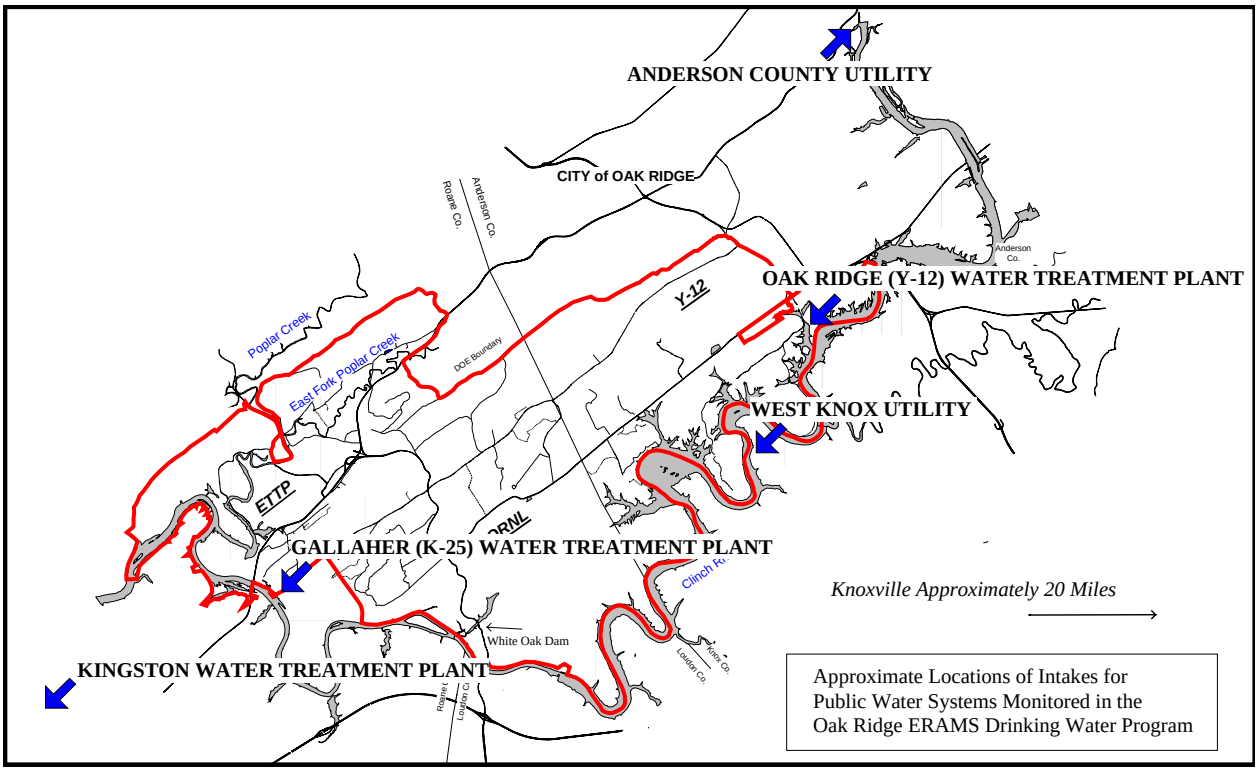

Figure 1: Approximate Locations of the Intakes for Public Water Systems Monitored in Association with EPA's Environmental Radiation Ambient Monitoring System (ERAMS) Drinking Water Program

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CHAPTER 4 GROUNDWATER MONITORING

Wells and Springs Sampling Work Plan

Introduction

The primary goals of the DOE-Oversight Division's groundwater sampling program are:

- Perform surveillance to detect changes in groundwater quality at select locations and;
- Locate groundwater exit pathways;
- Locate groundwater impacts from past DOE Oak Ridge Reservation (ORR) operations both on-site and off-site.
- Integrate groundwater sampling with surfaced water sampling to produce a comprehensive monitoring report.

This work plan concentrates on laboratory cost, number of sampling locations, and brief descriptions of activities or goals for the calendar year 2005 sampling season. The groundwater section is composed of one Geologist IV (supervisor) and one Geologist III (technical staff - position not filled).

Groundwater remediation projects, including Records of Decision, are being addressed with more regularity than in recent years. Monitoring well co-sampling and surface/spring "spot sampling" (sampling done impromptu in response to a technical decision) will increase from the past level of co-sampling and spot sampling. This increase is in support of remediation activities or new facilities like the Environmental Management Waste Management Facility (EMWMF) or Spallation Neutron Source (SNS). Most of the past spot sampling has been related to new locations being found or upon requests from the public. Most spot sampling costs are covered by routine locations that cannot be sampled due to low water conditions or other difficulties.

Parameters may vary depending on the potential groundwater contamination within a given area. Typical analytical parameters will include radionuclides, selected metals, and organic analyses. Additionally, as groundwater investigations to satisfy the *Tennessee Oversight Agreement* Attachment E.13 Groundwater Basin(s) Delineation are conducted, then fluorescent dyes analysis will be integrated into the groundwater-monitoring program/budget.

Water samples from residential wells/springs and non-community water systems using groundwater in close proximity of the ORR are included in this sampling program. Monitoring wells in DOE's programs for exit pathway, compliance, investigation, or plume delineation will be sampled less than springs. Springs are the best places to sample and compose the majority of independent sampling locations. Every effort will be made to coordinate groundwater sampling with adjacent surface water monitoring so as to provide a comprehensive and integrated report on the fate and transport of contaminants on and in the environs of the ORR. Other fieldwork related to the groundwater program without lab budget costs are:

- The inspection of wells;
- Locating new springs;
- Oversight of Underground Injection Control (UIC) wells and;
- Drilling of new wells or plugging of abandoned wells (P&A)

Methods and Materials

Sampling will generally be located along geologic strike and along cross strike geologic features, from the historically named Y-12, X-10, South Campus and the K-25 facilities. Water supply wells will be sampled by collecting water as close to the wellhead as possible. Water supply wells will be purged for at least 20 minutes or when seeing stabilization in field parameters. Monitoring wells will be co-sampled with facility personnel with few exceptions when disposable bailers might be used. Parameters, such as, pH, temperature, and conductivity will be collected before sampling and recorded on a sampling chain of custody sheets. Springs will be sampled based on field observation of flow and safety considerations.

Table 1 contains locations, analyses and sampling periods as described below. Specific radiochemical analyses will be determined prior to sampling or modified upon consultation with the Radiological Monitoring Oversight Program (RMO). Typically waters a priori influenced by K-25 would be analyzed for Tc-99. Water that may be influenced by X-10 will include (if gross beta results so warrant) Sr-90 analysis. If the gross alpha activity is greater than 5 pCi/L then a radionuclide isotope specific analysis for alpha emitters will be performed on the laboratory-archived sample.

New sampling locations will include cation/anion parameters in order to calculate ionic charge balances. A list of metals that may include the health-based ones will be considered for analysis at new locations. Volatile organic compounds (VOCs) will be sampled for at all new springs. At sampling points where metals, VOCs or radionuclides indicate a need to determine their variability then appropriate samples will be taken.

The TDEC analytical laboratory in Knoxville, Tennessee will furnish sample containers. Samples will be collected using approved TDEC and EPA sampling procedures. Vinyl exam gloves and decontamination equipment and procedures will be necessary to avoid cross contamination. TDEC DOE-O sample coolers will be used to insure that samples are preserved in route to the laboratory.

DOE Coordination/Communication

Upon selection of sampling points DOE will be notified by contacting the DOE Environmental Management Ground Water Program Manager, by e-mail and by letter. Ample notice will be given to DOE prior to sampling events to allow DOE the opportunity to observe or take split samples. Analytical results will be made available upon request.

All results and findings will be reported in the DOE-Oversight Division's Environmental Monitoring Report. It is anticipated there will be four sections in the 2004 Environmental Monitoring Report covering:

- Water Supply Sampling Results (private residential and non-community wells)
- Springs and Monitoring Wells
- Groundwater Tracing
- Chestnut Ridge Y-12 landfills
- Exit Pathway Investigations

Individual traces will be documented with dye amounts, placement locations and monitoring locations with addenda (see Map 1 Basin Delineation). These addenda will contain the following:

- type of dye to be flushed
- amount of dye to be flushed

- location of dye placement point(s)
- location of monitoring points
- maps showing location in relation to active or inactive DOE facilities

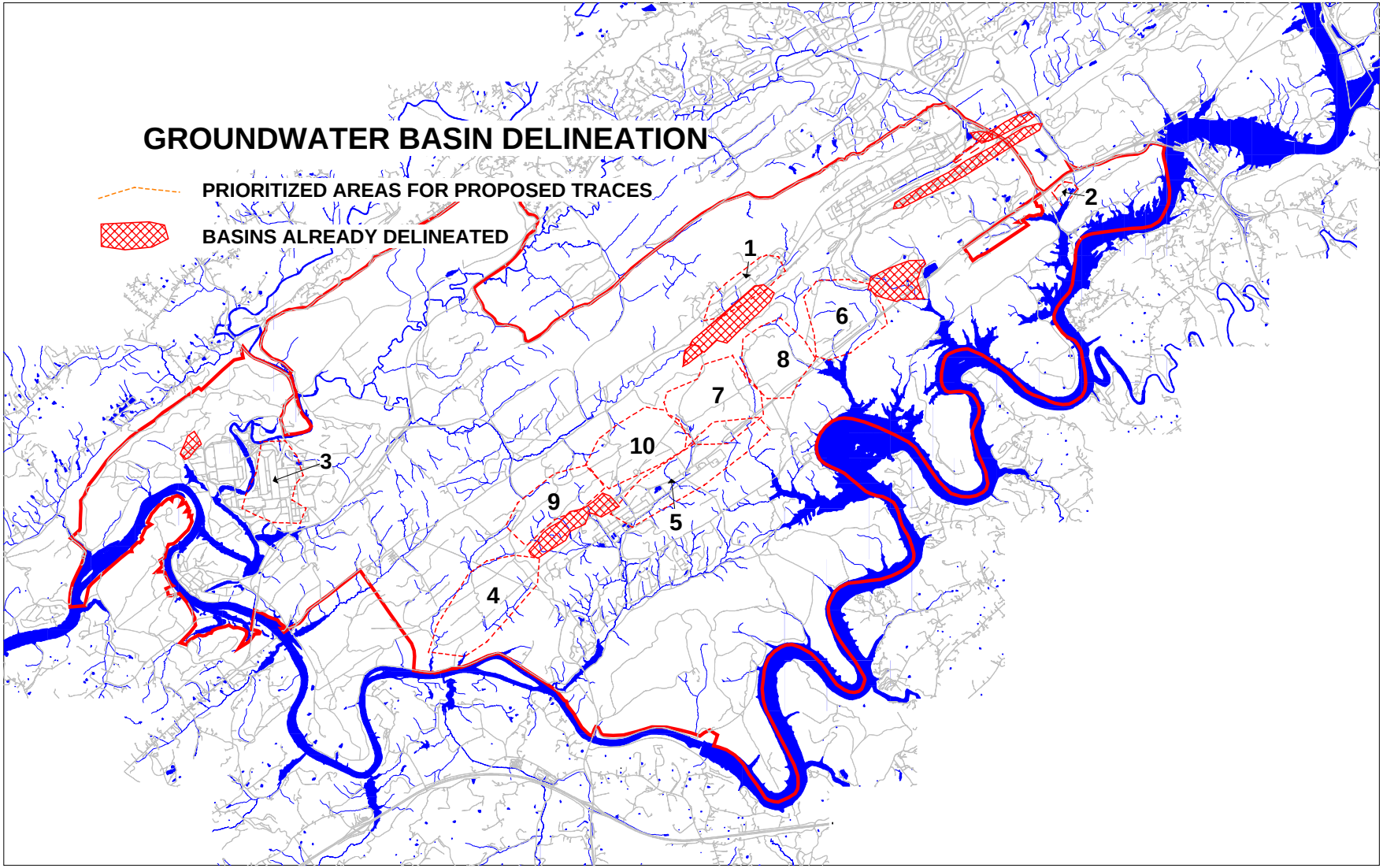
The addenda will be distributed to those individuals at the facilities (Resource Management Organization, Laboratory or Plant Shift Superintendent), DOE contacts, UT-Battelle/Bechtel Jacobs/BWXT contacts and the division managers.

Table 1

Sampling and Analysis Matrix for 2003 Groundwater Program					
Area	Quarters				Locations
	Q1	Q2	Q3	Q4	
Y-12 Landfills	Rad Met Inor Org			Rad Met Inor Org	1. Mossy Rock Spring 2. Cephus Spring 3. Cabin Spring
EMWMF	Rad Met Inor Org		Rad Met Inor Org		Combination of wells and springs at 4 Locations TBD
South Campus	VOCs		VOCs		1. Merak Spring 2. Co-Sample well TBD
Bear Creek	Rad VOCs Nut	Rad VOCs Nut	Rad VOCs Nut	Rad VOCs Nut	1. SS-7 Spring 2. SS-6 Spring 3. SS-5 Spring 4. New Weir 5. BC km-4.78
K-25	VOCs Rad		VOCs Rad		1. Spring 10-895 2. PCO Seep
	Rad VOCs	VOCs	Rad VOCs	VOCs	3. Spring 21-002 4. Exit pathways on east bank of Clinch River TBD
SNS	Rad		Rad		1. SNS Spring 1 2. SNS Spring 6 3. SNS Spring 4 4. SS-5 Spring 5. SS-6 Spring
Bethel Valley	Rad VOCs		Rad VOCs		1. Burns Cemetery 2. Raccoon Cr. Sp. 3. Crooked Tree

Table 1 cont'd

Scarboro/ Union Valley	Rad VOCs	VOCs	Rad VOCs	VOCs	1. Cattail Spring 2. Bootlegger Spring
Melton Valley	RAD VOCs		RAD VOCs		1. Picket Wells 2. Other locations TBD
Water Supply	Rad		Rad		2. New domestic water supply wells. 3. Older wells by request and with justification
Tracing	Dye Dye	Dye Dye	Dye Dye Dye Dye	Dye Dye Dye Dye	EMWMF SNS South Campus East Tennessee Technology Park Raccoon Creek Area
Rad = sample for radiochemicals.					
VOCs = samples for Volatile Organic Compounds					
Nut = samples for Nutrients (Nitrate – Nitrite)					
Met = a sample that is analyzed for Arsenic, Barium, Cadmium, Chromium, Mercury, Nickel, Lead, Potassium, Sodium, and Selenium.					
Inor = general inorganic parameters: Alkalinity as CaCO3, Boron, Chloride, Conductivity, Nitrogen NO3 & NO2, pH, residue dissolves, residue, suspended, sulfate					



Map 1. Basin Delineation

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CHAPTER 5 RADIOLOGICAL MONITORING

Ambient Gamma Radiation Monitoring of the Uranium Hexafluoride (UF6) Cylinder Yards at the K-25 (East Tennessee Technology Park) Site

Introduction

During the development and operation of the gaseous diffusion uranium enrichment process, containers, support equipment, and support facilities were designed, constructed, and used to store, transport, and process the depleted UF_6. After a significant inventory was produced, outdoor storage facilities "cylinder yards" evolved. Today, DOE operates four K-25 (East Tennessee Technology Park) UF_6 cylinder storage yards. They are used for the temporary and long-term storage of UF_6 cylinders. The goal of the DOE-O UF_6 Cylinder Yard dose assessment program is to evaluate if the public is protected from radiation doses emitted from the cylinder yards. This is especially important since one DOE mission is to transform the East Tennessee Technology Park into a commercial industrial park.

Methods and Materials

Dosimeters measure the dose from exposure to gamma radiation over time. The division's cylinder yard monitoring is performed using Luxel® OSL (optically stimulated luminescence) dosimeters. They are obtained from Landauer, Inc., in Glenwood, Illinois. Optically stimulated luminescence dosimeters have an exposure range from 1 mrem to 1,000 rem for X and gamma radiation and are generally placed in areas where exposures are expected to be significantly higher than background. The dosimeters are collected quarterly by division staff and shipped to Landauer for processing. To account for exposures that may be received in transit or storage, control dosimeters are included in each shipment from the Landauer Company. The control dosimeters are stored at the division office and returned to Landauer with the associated 'in the field' deployed dosimeters for processing. Any exposure received by the control dosimeters, which would include background radiation received while in storage at the division office (761 Emory Valley Road, Oak Ridge, Tennessee), is subtracted from the exposure reported for the field deployed dosimeters. Annually, the quarterly exposures (minus the exposure obtained from the control dosimeter) are summed for each location. The resultant annual dose is compared to the state/DOE primary dose limit for members of the public (100-mrem/yr exposure). In addition to radiation dose measurements being gathered, dosimeter location data has been obtained using Global Positioning System (GPS) equipment. This data has been incorporated into a mapping information computer program. The location data that has been entered into the MapInfo program will be incorporated with past radiation dose measurement data so the user will have the ability to select a particular dosimeter and view its historical dose exposure measurement.

The project is slowly coming to a close due to the shipment of the UF6 cylinders to Portsmouth Ohio for final disposition. The state will continue to monitor the cylinder yards as they are cleared, and for at least one quarter after the yards are completely empty or as long as contamination is a concern.

References

Landauer, Inc. *Landauer Service Guide*. Glenwood, Illinois. 1999.

MapInfo Corporation. *MapInfo Professional Version 4.0.2.* Troy, New York. 1996.

Tennessee Department of Environment and Conservation. 2001. *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee.* Oak Ridge, Tennessee.

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CHAPTER 5 RADIOLOGICAL MONITORING

Facility Survey Program and Infrastructure Reduction Activity

Introduction

The Tennessee Department of Environment and Conservation Department of Energy Oversight Division (the division), in cooperation with the U.S. Department of Energy and its contractors, operates a facility survey program (FSP) on the Oak Ridge Reservation (ORR). The DOE-O survey program provides a comprehensive, independent characterization of facilities on the ORR based on their: operational history, present mission and physical condition, inventories of radiological and/or hazardous materials, degree of contamination, contaminant release history, and potential for release of contaminants to the environment.

The goal of the program is to fulfill part of the commitments agreed to by the state of Tennessee and the Department of Energy in Section 1.2.3 of the *Tennessee Oversight Agreement,* which states that *"Tennessee will pursue the initiatives in attachments A, C, E, F, and G. The general intent of these action items is to continue Tennessee's: (1) environmental monitoring, oversight and environmental restoration programs; (2) emergency preparedness programs; and (3) delivery of a better understanding to the local governments and the public of past and present operations on the ORR and potential impacts on the human health and/or environment by the Oak Ridge Reservation."* As part of this larger endeavor, *the facility survey program is designed to provide a detailed assessment of all potential hazards affecting or in any way associated with facilities on the Oak Ridge Reservation.* To meet this objective, survey team members walk through each facility and gather information that is recorded in a database that allows the team to characterize facilities and evaluate their potential for release of contaminants to the environment (PER). The conditions of facilities are considered within a variety of environmental conditions ranging from catastrophic (i.e. tornado, earthquake) to normal everyday working situations. From an emergency preparedness perspective such information is essential.

In 2002, the Department of Energy instituted a formal, accelerated D&D program aimed at facility reduction through demolition. Facility survey staff responded to this activity by making facility visits and walk-throughs of each facility prior to and during demolition. Information concerning the nature and destination of waste streams from the demolition sites is gathered and submitted to the division's Waste Management section. This activity will continue in 2004.

Methods and Materials

The criteria used in the selection of facilities to be surveyed include: 1) position of facility in S&M/D&D Programs; 2) perceived physical condition of facility; 3) perceived levels of contamination; 4) types or quantities of inventories (hazardous or radiological); and; 5) special circumstances (incidents, public or other agency request, or other unforeseen situations).

Using standard radiation survey instruments, inventory data, and historical documentation, staff walk through each facility and record information in a questionnaire format. Based on these results and professional judgement, staff then rank the potential for release of contaminants to the environment (PER) for each facility by scoring 0 (least potential) to 5 (greatest potential) for each of 10 "categories." Tables 1 and 2 illustrate the scoring guidelines for potential environmental release, and the categories to be scored.

Table 1: Potential for Environmental Release Scoring Guidelines

Score	Score is based on observations in the field and the historic and present-day threat of contaminant release to the environment/building and/or ecological receptors.
0	No potential: no quantities of radiological or hazardous substances present.
1	Low potential: minimal quantities present, possibility of an insignificant release, very small probability of significant release, modern maintained containment.
2	Medium potential: radiological or hazardous subs. present, structures stable in the near to long term, structures have integrity but are not state-of-the-art, adequate maintenance.
3	Medium potential: structures unstable, in disrepair, containment failure clearly dependent on time, integrity bad, maintenance lacking, containment exists for the short term only.
4	High potential: radiological or hazardous subs. present. Containment for any period of time is questionable, migration to environment has not started.
5	Radiological or hazardous substance containment definitely breached, environmental/interior pollution from structures detected, radiological and/or hazardous substances in inappropriate places like sumps/drains/floors, release in progress, or radiological exposure rates above Nuclear Regulatory Commission (NRC) guidance.
Note: A score of 0 or 1 designates a low Potential Environmental Release rank; a score of 2 or 3 designates a moderate rank; a score of 4 or 5 designates a high rank.	

Table 2: Ten Categories Scored

1.	Sanitary lines, drains, septic systems
2.	Process tanks, lines, and pumps
3.	Liquid Low-level Waste tanks, lines, sumps, and pumps
4.	Floor drains and sumps
5.	Transferable radiological contamination
6.	Transferable hazardous materials contamination or waste
7.	Ventilation ducts and exit pathways to create outdoor air pollution
8.	Ventilation ducts and indoor air/building contamination threat
9.	Escalated radiation exposure rates inside the facility
10.	Escalated radiation exposure rates outside the facility

As facilities are surveyed, scored, and compared with each other, a relative "potential for environmental release" will emerge. The facilities that show a high potential for release of contaminants will be noted in the program's annual report. Staff will revisit these facilities at their discretion to evaluate changing conditions. Table 3 provides a list of target facilities to be surveyed during the next year.

Table 3: Target Schedule of Facilities to be Surveyed *

ORNL		Y-12		K-25	
Facility	Date	Facility	Date	Facility	Date
X-3550	**Jan. 15**	**Y-9720-16**	**Jan. 15**	**On Demand**	
X-3030	**Feb. 15**	**Y-9720-53**	**Feb. 15**		
X-3031	**Mar. 15**	**Y-9720-6**	**April 15**		
X-3032	**May 15**	**Y-1501-2**	**June 15**		
X-3033	**June 15**	**Y-9404-9**	**Aug. 15**		
X-3029	**July 15**	**Y-9720-19**	**Oct. 15**		
X-3005	**Sept. 15**	**Y-9720-19A**	**Dec. 15**		
On Demand		**Y-9720-19B**	**Dec. 15**		

***Facility numbers and dates are subject to change.**

Appendices

None

References

Tennessee Department of Environment and Conservation. 2001. *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee.* Oak Ridge, Tennessee.

Yard, C.R. 1998. *Emergency Response Procedures Manual*. Tennessee Department of Environment and Conservation, Department of Energy Oversight Division. Oak Ridge, Tennessee.

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CHAPTER 5 RADIOLOGICAL MONITORING

Walkover Radiological Surveys

Introduction

The Tennessee Department of Environment and Conservation Department of Energy Oversight Division (the division) with the cooperation of the U.S. Department of Energy and its contractors conduct periodical radiological walkover surveys for the purpose of evaluating DOE property for re-use. Walkover surveys are done in conjunction with the CERCLA 120(h) process of establishing clean areas while following direct guidelines. In addition, walkover surveys may also be conducted on an as needed basis in conjunction with other special projects or on-going activities.

Background History of the Project

The Footprint Reduction Project focused on land parcels of the Reservation, considered not to be impacted by former DOE activities. This current project will focus on those areas suspected of being impacted that will require minimal or no remediation, once a valid investigation and survey is concluded. Table 1 lists those areas of concern generated during the Footprint Reduction Project that will be revisited. Note: Parcel 2 – East Black Oak Ridge Study Area, Parcel 3 – McKinney Ridge Study Area, Parcel 12 – Park City Road Study Area, and Parcel 14 – Gallaher Bend/Bull Bluff Study Area had no specified concerns during the Oversight's walkover. Table 2 lists those areas of low priority under Appendix C of the Federal Facility Agreement. In addition, this project will incorporate haul roads used by DOE for the transport of radiological waste. Reeves Road is currently being monitored. Under a modified DOE Order 5400.5, any areas exceeding 200 dpm/100cm2 removable beta, 1000 dpm/100cm2 total beta, 20 dpm/100cm2 removable alpha, and 100 dpm/100cm2 total alpha would require remediation. These values are conservative based on the actual DOE Order 5400.5 for these contaminants.

Methods and Materials

The Walkover Surveys are conducted using a physical approach. Background material of the area is evaluated prior to a drive through of the area. From there, a walkover of the area is conducted with the use of a sodium iodide (gamma detector). Other radiological instruments are on hand as necessary. These include a beta-gamma pancake, a zinc scintillator for alpha, a micro-rem for tissue dose equivalence and a gamma spectroscopy for isotope identification. Areas with staining of soil or stressed vegetation are noted for sampling.

Staff conducts a thorough walkover of the area with the use of a global positioning system (GPS). Areas of concern, as well as other points, are logged to show coverage. A map of the area is printed out with points of interest or concerns plotted. A report is generated with the state's findings. Concerns are brought to the attention of the Federal Facility Agreement Project Managers for resolution.

Table 1
List of Maintenance Action Sites Identified by TDEC Field Surveys
Footprint Reduction Process

Parcel 1: West Black Oak Ridge Study Area

- TDEC field station 101: Abandoned 55-gallon steel drum (empty)
- TDEC field station 127: Old dumpsite (tires, roofing, scrap metal, etc)
- TDEC field station 129: Small shed with above background levels of fixed gamma contamination
- TDEC field station 134: Large abandoned hollow fill

Parcel 4a: East Fork Ridge/White Wing Study Area

- TDEC field stations 24 & 125: Abandoned 55-gallon drums
- TDEC field stations 105-125: Numerous abandoned hydrologic experimental equipment
- TDEC field station 157: Remains of plywood shack and drums

Parcel 4b: Pine Ridge Study Area

- TDEC field station 89: Abandoned barrel with residual fuel oil

Parcels 5/6: West Pine Ridge Study Area

- TDEC field station 44: Old Dump Site at west end of Happy Valley Campsite
- Radiological surveys should be conducted prior to use of federal land adjacent to the Consolidated Clinch River Industrial Park to ensure potential exposure is minimized

Parcels 7/18: West Chestnut Ridge/West Bethel Valley Study Area

- TDEC field station 14: Abandoned 55-gallon drum
- TDEC field station 26: Pile of scrap metal
- TDEC field station 35: Abandoned automatic sampling equipment along small creek
- TDEC field station 49: Experimental hydrologic site with abandoned apparatus & gear (messy)
- TDEC field station 89: Abandoned hyrdologic/precipitation experimental equipment
- TDEC field station 103: Abandoned soil percolation test trenches & gear
- TDEC field station 105: Abandoned hydrologic experimental equipment strewn about the hillside
- TDEC field station 114: Abandoned experimental site & gear
- TDEC field station 193: Abandoned percolation test trench & gear
- TDEC field stations 250/251: Abandoned hydrologic test site with a tremendous amount of gear/trash

Parcel 8: Central Chestnut Ridge Study Area

- TDEC field station 15 vicinity: Debris & scrap metal strewn about the NOAA/ATDD facility
- TDEC field station 168: Possible SWMU site identified by ORNL personnel; dumped asphalt, concrete & fairly recent garbage disposal

Parcel 9: Walker Branch Study Area

- Removal action is recommended for abandoned experimental gear, scrap metal, hydrologic test equipment, & trash strewn about the parcel
- TDEC field station 77: Removal action for miscellaneous trash & debris associated with the new SWMU 0.81 site located between Old & New Bethel Valley Road

Parcel 11: Copper Ridge Study Area

- TDEC field station 27: General vicinity of the Civil Defense Bunker needs "policing up"
- TDEC field stations 119 & 297: Abandoned drums
- TDEC field station 250: Abandoned & unidentified waste dump (scrap metal, blocks, bricks, etc)
- TDEC field station 313: Tire dump
- TDEC field station 133: Gamma-contaminated site along old road bed overlooking HFIR

Parcel 13/19: West Haw Ridge/Bearden Creek Watershed Study Area

- TDEC field station 12: Previously unidentified SWMU contaminated with Cs-137
- TDEC field station 89: Previously unidentified SWMU dump (lab equipment, scrap metal, etc)
- TDEC field station 21: Small dump site adjacent to Melton Valley Access Road which is slightly rad-contaminated
- TDEC field stations 50 & 139: Abandoned, empty 55-gallon drums

Parcel 15: Freels Bend Study Area

- TDEC field stations 35 & 36: Existing barns need to be cleared of trash
- TDEC field station 21: Variable Dose Rate Irradiation Facility (VDRIF) facility needs to have shielding blocks removed from the roof of the structure
- TDEC field station 6: Abandoned 55-gallon drum partially submerged in a cove of the Melton Lake
- TDEC field station 21: Demolition debris needs cleaned up & removed
- TDEC field station 52: Trash & debris disposed in large sinkhole
- TDEC field station 23: A small subterranean vault outside the VDRIF facility that held lead source rods; vault reportedly filled with sand; no rad contamination found by TDEC field survey; follow-up sampling?

Parcel 16: Scarboro/East Haw Ridge Study Area

- TDEC field station 6: Anomaly 12 at contaminated trailer
- TDEC field station 7: Building 1404-7 at the location of a radiologically-contaminated hopper

Parcel 20: East Chestnut Ridge Study Area

- TDEC field station 36: Abandoned scrap pile/other refuse along the Brush Burn Access Road
- TDEC field station 38: Abandoned scrap metal/asbestos pile located north of Rogers Quarry
- TDEC field station 39: Abandoned scrap metal pile located north of the Rogers Quarry highwall

Table 2
Appendix C – Site Evaluation Areas (low risk)

ETTP – K-25 Site

- Powerhouse Knoll Study Area (#21a): 137 acres
- Duct Island Study Area (#21b): 90 acres
- Contractor's Road Study Area (#21c): 57 acres
- Wheat Knoll Study Area (#21d): 180 acres
- Cooper Road Bend
- Perimeter Road Fill Area: 18.9 acres

ORNL – Bethel Valley

- 0900 Firearms Range…RSE in progress
- Abandoned Burn Pit (SWMU # 0.1)
- Compactible Waste Facility Site (SWMU # 0.75)
- Cs-134 Tagged Tree
- Cs-137, Co-60 Contaminated Forest Area
- Freels Bend Study Area (#15): 1,535 acres…Remedial Site Evaluation (RSE) in progress
- Old Bethel Valley Road Dump Site (SWMU # 0.81)
- Walker Branch Study Area (#9): 1,304 acres…RSE planned
- West End Dump Site (SWMU # 0.61)

ORNL – Melton Valley

- Bearden Creek Road Dump Site (SWMU # 8.27)
- Buried Scrap Metal Area (SWMU # 16.3)
- Contaminated Debris Site Adjacent to Building 7819 (SWMU # 7.10)
- Cs-137 Contaminated Meadow
- Cr-51 Contaminated Grass Plots…RSE in preparation – Fall 1998
- Reactive Chemicals Disposal Area (7659B) (SWMU # 19.6)
- Soil Injection of Radioactive Gas (7659C)
- HFIR Drive Disposal Site…proposed inclusion (SWMU # 8.28)

Y-12 National Security Complex – Bear Creek Valley

- East Fork Ridge Knob
- White Wing Scrap Yard - East Creek
- White Wing Scrap Yard – West Creek
- Y-12 Water Treatment Plant Study Area (#4c): 130 acres

Y-12 National Security Complex – Upper East Fork Poplar Creek

- Building 9201-5E Northeast Yard Waste Storage Area
- Building 9202 East Pad Waste Storage Area
- Building 9204-2 West Yard Waste Storage Area
- Building 9215 West Pad Waste Storage Area
- Building 9401-3 East Yard Waste Storage Area

Y-12 National Security Complex – Upper East Fork Poplar Creek (continued)

- Building 9404-11 West Yard Waste Storage Area
- Building 9620-2 West Yard Waste Storage Area
- Building 9720-13 West Yard Waste Storage Area
- Building 9720-3 North Yard Waste Storage Area
- Building 9720-6 North Polytank Station
- Building 9744 North Dock Waste Storage Area
- East Chestnut Ridge Study Area (#20): 1400 acres
- Polytank Station (Building 9206)
- Prenco Incinerator (SWMU # YT-001)
- Tank 2077-U
- Tank 2089-U
- Tank 2090-U
- Tank 2091-U
- Tank 2092-U

Y-12 National Security Complex – Areas outside Watersheds

- Chestnut Ridge Borrow Area Waste Pile (SWMU # YS-042)
- Scarboro Facility Study Area (#17): 82 acres
- Temporary Storage Area (SWMU # YS-126)
- Non-Plant Reservation Groundwater

References

Federal Facility Agreement, January 1992. (with revisions)

Tennessee Department of Environment and Conservation, Department of Energy Oversight Division. *Environmental Restoration Footprint Reduction Process*. Oak Ridge, Tennessee.

Tennessee Department of Environment and Conservation, *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee*. Oak Ridge, Tennessee. 2001.

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CHAPTER 5 RADIOLOGICAL MONITORING

Ambient Gamma Radiation Monitoring of the Oak Ridge Reservation Using Environmental Dosimetry

Introduction

Gamma radiation is emitted by various radionuclides that have been produced, stored, and disposed on the Oak Ridge Reservation (ORR). Associated radionuclides are evident in ORR facilities and surrounding soils, sediments, and waters. In order to assess the risked posed by these contaminants, the Tennessee Department of Environment and Conservation DOE Oversight Division (the division) began monitoring ambient gamma radiation levels on the ORR in 1995. This program is intended to provide:

- conservative estimates of the potential dose/risk to members of the public from exposure to gamma radiation attributable to DOE activities/facilities on the ORR;
- baseline values used to assess the need/effectiveness of remedial actions;
- information necessary to establish trends in gamma radiation emissions;
- information relative to the unplanned release of radioactive contaminants on the ORR.

In this effort, environmental dosimetry is used to measure the radiation dose attributable to external radiation at selected monitoring stations located on and in the vicinity of the Oak Ridge Reservation.

Methods and Materials

Dosimeters used in the program will be obtained from Landauer, Inc., at Glenwood, Illinois. Each of the dosimeters deployed in the program will use aluminum oxide photon detectors to measure the dose from gamma radiation (minimum reporting value = 1 mrem). At locations where there is a potential for the release of neutron radiation, the dosimeters will also contain an allyl diglycol carbonate based neutron detector (minimum reporting value = 10 mrem).

Dosimeters that contain only photon detectors, alone, will be collected quarterly and sent to Landauer for processing. Dosimeters that contain both photon and neutron detectors will be collected and processed semiannually. To account for exposures that may be received in transit or storage, control dosimeters will be included in each shipment from the Landauer Company. These dosimeters will be stored in a lead container at the division office and returned to Landauer with the associated field deployed dosimeters for processing. Any exposure received by the control dosimeters will be subtracted from the dose reported for the field deployed dosimeters. At the end of the year, the results will be summed for each location and the resultant annual dose compared to background values and the state/DOE primary dose limit for members of the public (100 mrem/year).

Monitoring stations are chosen to identify sources of external radiation on the ORR, develop conservative estimates of the dose to the public from DOE operations/facilities, and collect information relative to the need and/or effectiveness of remediation. Candidate monitoring stations include: operating facilities; locations on the ORR that are accessible to the public; sites at the perimeter of the reservation near known radiation sources; local communities; and sites subject to or undergoing remediation. Temporary dosimeters may be placed at some locations for short term monitoring. The sites currently monitored in the program are provided in Table 1.

Table 1: Locations of Environmental Dosimeters Deployed on the Oak Ridge Reservation

Station Number (Dosimeter Type)	Location	Station Number (Dosimeter Type)	Location
9. (Photon)	Norris Dam Air Monitoring Station	48.(Photon)	Temp. 1: ETTP K-1420 Building
11.(Photon)	ETTP Grassy Creek Embayment on the Clinch River	51.(Neutron-Photon)	ETTP north side of the K-1066-E UF_6 Cylinder Storage Yard
12.(Neutron-Photon)	ETTP UF_6 Cylinder Yard K-1066-E	53.(Neutron-Photon)	ETTP southwest corner of the K-1066-K UF_6 Cylinder Storage Yard
15.(Photon)	ETTP K-1070-A Burial Ground	53a(Neutron/Photon)	ETTP southwest corner of the K-1066-K UF_6 Cylinder Yard (duplicate)
16.(Photon)	ETTP K-901 Pond	55.(Photon)	Temp. 8: ORNL SWSA 5 Tru Trench
17.(Neutron-Photon)	ETTP K-1066-K UF_6 Cylinder Yard	56.(Photon)	Temp. 9: ORNL Old Hydrofracture Pond
18.(Photon)	ETTP TSCA on fence across from Tank Farm	56a.(Neutron-Photon)	ORNL Old Hydrofracture Pond (duplicate)
20.(Photon)	ORNL Freels Bend Entrance	57.(Photon)	Temp. 10: ETTP UF6 Cylinder Storage Yard K-1066-B
21.(Photon)	ETTP White Wing Scrap Yard	61.(Photon)	Temp. 14: Outer & Illinois Ave
22.(Photon)	ORNL High Flux Isotope Reactor	62. (Photon)	Temp. 15: East Pawley
22a.(Photon)	ORNL High Flux Isotope Reactor (duplicate)	63.(Photon)	Temp. 16: Key Springs Road
23.(Photon)	ORNL Solid Waste Storage Area 5	64.(Photon)	Temp. 17: Cedar Hill Greenway
24.(Photon)	ORNL Building X-7819	65.(Photon)	Temp. 18: California Ave.
25.(Photon)	ORNL Molten Salt Reactor Experiment	66.(Photon)	Temp. 19: Emory Valley Greenway
26.(Photon)	ORNL Cesium Fields	67.(Photon)	Temp. 20: West Vanderbilt
27.(Photon)	ORNL White Oak Creek Weir @ Lagoon Rd	68. (Photon)	White Oak Creek @ Coffer Dam
28.(Photon)	ORNL White Oak Dam	69.(Photon)	ORNL Graphite Reactor
30.(Photon)	ORNL X-3513 Impoundment	70.(Photon)	Scarboro Perimeter Air Monitoring Sta.
31.(Photon)	ORNL @ Cesium Forest boundary	71.(Photon)	Y-12 East Perimeter Air Monitoring Sta.
31a.(Photon)	ORNL @ Cesium Forest boundary (duplicate)	72.(Photon)	ETTP Visitors Center
32.(Photon)	ORNL Cesium Forest on tree	73.(Photon)	Temp. 3: ORNL Spallation Neutron Source (north side)
33.(Photon)	ORNL Cesium Forest Satellite Plot	74.(Photon)	Temp. 4: ORNL Spallation Neutron Source (south side)
34.(Photon)	ORNL SWSA 6 on fence @ Highway 95	75.(Photon)	Temp. 5: ORNL hot spot on Haw Ridge
35.(Photon)	ORNL confluence of White Oak Creek & Melton Branch	78.(Photon)	Temp. 11: ED3 Quarry at Blair Road
38. Photon)	Y-12 Uranium Oxide Storage Vaults	79. (Photon)	Temp.12: ED1 on pole
39.(Photon)	Y-12 @ back side of Walk In Pits	80.(Photon)	Temp.13: Elza Gate
41.(Photon)	ORNL North Tank Farm	81.(Photon)	ORNL visitors center
42.(Photon)	ETTP east side of the K-1401 Building		
43.(Photon)	ETTP west side of the K-1401 Building	83.(Photon)	Walk in Pit W/ Radon Detector
44.(Photon)	ETTP K-25 Building		
45.(Photon)	ETTP K-770 Scrap Yard	85.(Photon)	Background at Ft. Loudoun Dam
46.(Photon)	ORNL Homogeneous Reactor Experiment Site	86.(Neutron-Photon)	Background at Ft. Loudoun Dam
47.(Photon)	Y-12 Bear Creek Road ~ 2800 feet from Clinch River		

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Tennessee Department of Environment and Conservation. *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee*. Oak Ridge, Tennessee. 2001.

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CHAPTER 5 RADIOLOGICAL MONITORING

Real Time Ambient Gamma Monitoring of the Oak Ridge Reservation

Introduction

The Tennessee Department of Environment and Conservation DOE Oversight Division (the division) in association with its Ambient Gamma Radiation Monitoring Program has deployed continuously recording exposure rate monitors at various locations on the Oak Ridge Reservation since 1996. These instruments record gamma radiation levels at variable intervals for extended periods of time. The instruments have primarily been used to monitor remedial activities and supplement the integrated dose rates provided by environmental dosimeters. While the dosimeters used in the division's Ambient Gamma Radiation Monitoring Program provide the cumulative dose over time when processed, data do not indicate the specific time and magnitude of fluctuations in the dose rates. Consequently, a series of small releases cannot be distinguished from a single large release using the dosimeters alone. The continuous exposure rate monitors have the capacity to provide an exposure rate profile that can be correlated with changing environmental and/or anthropogenic conditions.

Methods and Materials

The continuous exposure rate monitors that will be used in the program incorporate detection equipment, power supply, software, and associated instrumentation in a portable weather resistant case. The units are capable of measuring and recording gamma exposure rates from 1 μR/hr to 1 R/hr at predetermined intervals (one minute to two hours) over long periods of time (e.g., a year). Associated data can be downloaded in the field using an infrared transceiver and a lap top computer.

Monitoring in the program will focus on the measurement of exposure rates under conditions where gamma emissions are expected to fluctuate substantially over short time periods or there is a potential for the release of gamma emitting radionuclides. The primary areas monitored in the program will be associated with remedial activities at locations where gamma radiation is known to be a concern. Monitoring stations can be expected to vary as the sites subject to remediation change and findings warrant. Sites currently monitored in the program include the Environmental Management Waste Management Facility (Y-12), the Y-12 Landfill (Y-12), Solid Waste Storage Area 5 (ORNL), and a background station at Fort Loudoun Dam. Data collected from the sites of interest will be compared to the state limits for exposures to the public (2,000 μrem/hr) and the data collected at the background station.

References

Tennessee Department of Environment and Conservation. *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee*. Oak Ridge, Tennessee. 2001.

Yard, C.R., 2004. *Health, Safety, and Security Plan.* Tennessee Department of Environment and Conservation, Department of Energy Oversight Division. Oak Ridge, Tennessee.

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CHAPTER 5 RADIOLOGICAL MONITORING

Surplus Material Verification

Introduction

The Tennessee Department of Environment and Conservation Department of Energy Oversight Division (the division), in cooperation with the U.S. Department of Energy and its contractors, conducts random radiological surveys of surplus materials that are destined for sale to the public on the Oak Ridge Reservation (ORR). In addition to performing the surveys, the division reviews the procedures used for release of materials under DOE radiological regulations. Also reviewed are any occurrence reports that involve surplus materials. Some materials, such as scrap metal, may be sold to the public under annual sales contracts, whereas other materials are staged at various sites around the ORR awaiting public auction/sale. The division as part of its larger radiological monitoring role on the reservation conducts these surveys to help ensure that no potentially contaminated materials reach the public. In the event that radiological activity is detected, the division will immediately report to the responsible supervisory personnel of the surplus sales program and follow their response to the notification to see that appropriate steps (removal of items from sale, resurveys, etc.) are taken to protect the public.

Methods and Materials

Staff members make random surveys of items that are arranged in sales lots by using standard survey instruments. Potential items range from furniture and computer equipment to vehicles and construction materials. Particular survey attention is paid to smaller equipment and parts. Where "green tags" are attached, radiation clearance information is compared to procedural requirements. If any contamination is detected during the on-site survey, the surplus materials manager for the facility will be notified immediately. In addition to radioactivity, any chemical concerns will be immediately brought to the attention of the manager.

References

Tennessee Department of Environment and Conservation. *Tennessee Oversight Agreement. Agreement between the U.S. Department of Energy and the state of Tennessee*. Oak Ridge, Tennessee. 2001.

Yard, C.R. 2004. *Health, Safety, and Security Plan*, Tennessee Department of Environment and Conservation, Department of Energy Oversight Division. Oak Ridge, Tennessee.

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CHAPTER 6 SURFACE WATER MONITORING

Bacteria Levels of East Fork Poplar Creek

Introduction

According to the 2002 305(b) Report, *The Status of Water Quality in Tennessee*, roughly 155 river miles in Tennessee are currently posted for no water contact due to high bacterial levels. East Fork Poplar Creek (EFPC) has a bacterial advisory from its mouth to Mile 15.0. Generally, sources of fecal contamination to surface waters include wastewater treatment plants, on-site septic systems, domestic and wild animal manure, and urban runoff.

The Y-12 National Security Complex discharges treated wastewater from its sewage treatment plant into East Fork Poplar Creek (EFPC). In recent years, Y-12 has upgraded its sanitary wastewater treatment system. However, concerns remain that effluent from Y-12 may impact surface water bacteriological levels in EFPC. Results from this bacteriological sampling of EFPC will aid TDEC/DOE-O in addressing whether Y-12 is a significant contributor to fecal contamination levels in the creek.

Because they are commonly found in human and animal feces, members of two bacteria groups, coliforms and fecal streptococci, serve as indicators of possible sewage contamination. Although usually not harmful themselves, they indicate the presence of pathogenic bacteria, viruses, and protozoans that also live in human and animal digestive systems. Many states still use the pre-1986 standard for fecal coliform as the numeric criterion to protect recreational uses of water. Studies conducted by the EPA suggest that the best indicators of health risk from recreational water contact in fresh water are E. coli and enterococci. E. coli is a species of fecal coliform bacteria that is specific to fecal material from humans and other warm-blooded animals. A subgroup of the fecal streptococcus group, Enterococci are typically more human-specific than the larger fecal streptococci group. The EPA recommends that states transition to the E. coli and enterococci criteria because these bacteria indicators correlate more closely to gastrointestinal problems than the fecal coliform indicator. Effective January 7, 2004, the state of Tennessee adopted the E. Coli criterion.

Bacteriological samples of surface water will be collected at ten locations along EFPC. The sites follow EFPC from Station 17, where EFPC leaves the Oak Ridge Reservation, to the river mile 6.3 at the bridge crossing on Highway 95. A revised set of sampling sites was selected for the 2005 study. In previous studies, several sites were chosen due to their proximity to locations associated with sewer overflows. The overflow problems have since been rectified. These have been replaced with sites picked for proximity to potential sources of bacteriological contamination as EFPC makes its way near downtown Oak Ridge. The old sampling site below the confluence of EFPC with Poplar Creek has been dropped in favor of the sampling site at river mile 6.3, a monitoring site for BMAP studies.

Site Number	Location (See Figure 1)
1	Y-12 Station 17
2	Behind Dean Stallings Ford off Illinois Avenue
3	Bridge Crossing at Tuskegee Drive
4	Tributary of EFPC at Raccoon Road Bridge Crossing near Bissell Park
5	Near East Vanderbilt Drive
6	Substation near intersection of Oak Ridge Turnpike & Illinois Avenue
7	Oak Ridge Turnpike next to Jefferson Street Shell Station
8	~ 366 feet above the Oak Ridge Sewage Treatment Plant
9	~ 190 feet below the Oak Ridge Sewage Treatment Plant
10	Highway 95 EFPC Mile 6.3

Methods and Materials

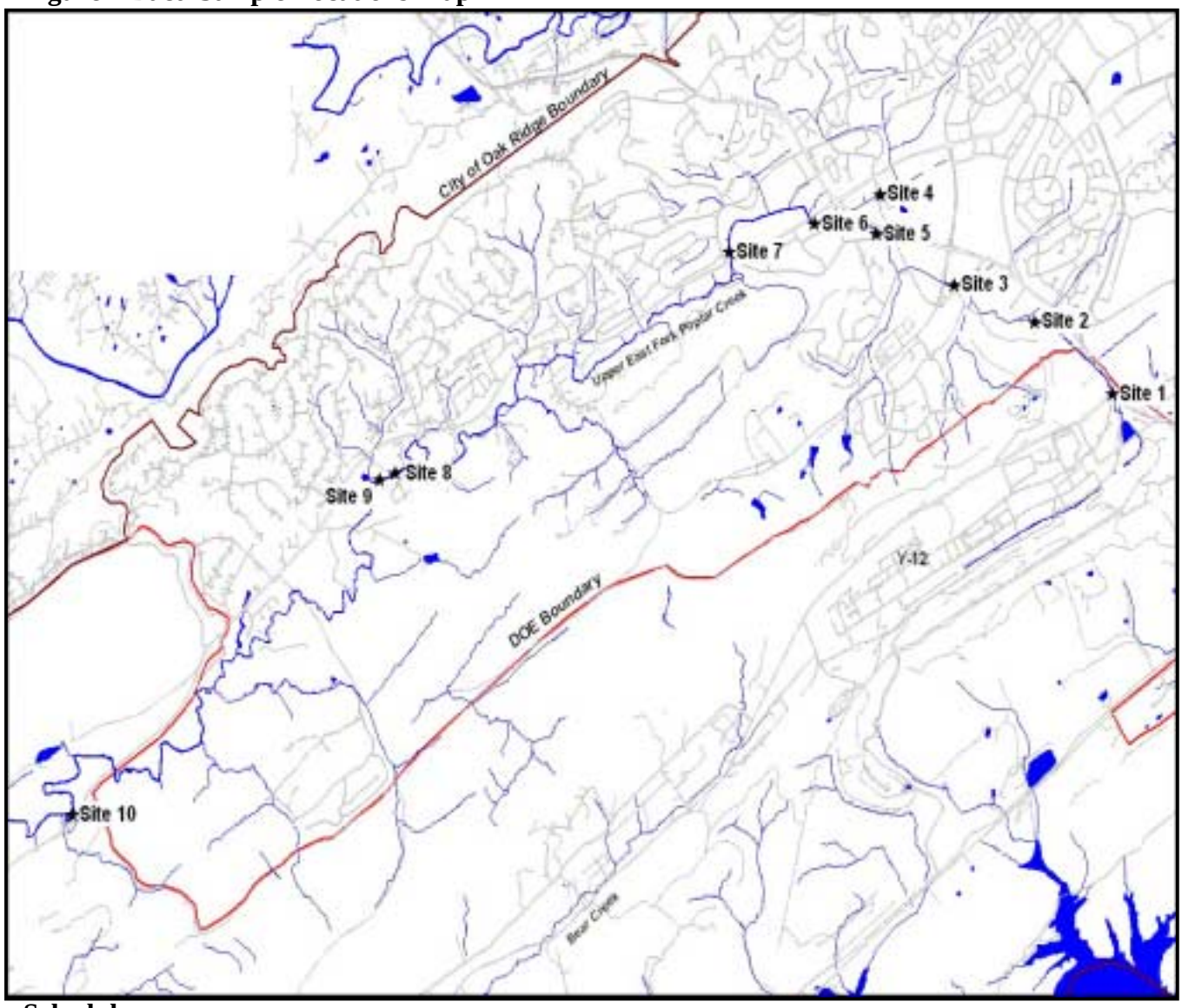
Parameters

E. coli, Enterococcus

Procedure Background

The revised Tennessee General Water Criteria (Rule 1200-4-3-.03) state that the concentration of the E. coli group shall not exceed 126 colony-forming units per 100 ml, as a geometric mean based on a minimum of 5 samples collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. For the purposes of determining the geometric mean, individual samples having an E. coli concentration of less than 1 per 100 ml shall be considered as having a concentration of 1 per 100 ml.

Figure 1 Bacti Sample Locations Map



Schedule

Sampling will be conducted during a thirty-day period extending from late May 2005, into June 2005.

Procedure Overview

Grab samples will be collected from each sampling location. A clean pair of disposable latex or vinyl gloves will be worn each time a different location is sampled. Gloves will be donned immediately prior to sampling. At each location, a grab sample will be collected in 100 ml sterile plastic, bacteriological sampling bottles. To prevent cross-contamination, samples will be placed in self-sealing plastic bags and then stored on ice at the time of collection. Care will be taken to ensure that the sample containers do not become submerged beneath melted ice, as this might result in the cross-contamination of samples.

Laboratory Procedures

The Tennessee Department of Health, Environmental Laboratory and Microbiological Laboratory Organization (Laboratory Services) provides analytical services to the TDEC DOE-O. The Knoxville branch of Laboratory Services will analyze the bacteriological samples following appropriate methods detailed in *Standard Methods for the Examination of Water and Wastewater,* 20th edition.

References

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CHAPTER 6 SURFACE WATER MONITORING

Rain Event Surface Water Monitoring

Introduction

Heavy rainfall events have the capability of transporting significant quantities of contaminants, which would normally remain in place, into nearby bodies of water. This mass transport can in turn impact the quality of the receiving waters. Due to the presence of areas of extensive point and non-point source contamination on the Oak Ridge Reservation (ORR), there exists the potential for contamination to impact surface waters on the ORR during excessive rain events. These events could cause the displacement of contamination that would not normally impact streams around the ORR.

To assess the degree of surface water impact caused by these rain events, a sampling of streams will be conducted following heavy rain events to determine the presence or absence of contaminants of concern. Table 1 shows locations that have been selected for sampling.

Table 1. Sample Locations

Site	Location
EFK 23.4	Station 17
WCK 3.0	White Oak Creek at Lagoon Road
MEK 0.1	Melton Branch Weir
MIK 0.1	Mitchell Branch Weir
BCK 4.5	Bear Creek Weir at Hwy. 95
MBK 1.6	Mill Branch (Reference)

Methods and Materials

In addition to temperature, pH, and conductivity, the following parameters will be analyzed for:
Inorganics: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, zinc, nitrogen (NO_2 & NO_3), ammonia, nitrogen (total Kjeldahl), total phosphates.

Other tests: E. coli, Enterococcus, dissolved residue, suspended residue, and total hardness.

Radionuclides: Gross alpha, gross beta, gamma radionuclides.

Schedule

The monitoring will be conducted no more than once per quarter following either a 1” rain event in a 24-hour period or a 2” rain event over a 72-hour period.

Standard Operating Procedures

Special care must be taken when sampling water in which contaminants can be detected in the parts per billion and/or parts per trillion range. In order to prevent cross-contamination of these samples, the following precautions shall be taken when trace contaminants are of concern:

- A clean pair of new, non-powdered, disposable latex or vinyl gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should not come into contact with the media being sampled.

- Sample containers for source samples or samples suspected of containing high concentrations of contaminants should be placed in separate plastic bags immediately after collecting, tagging, etc.

- If possible, ambient samples and source samples should be collected by different field teams. If different field teams cannot be used, all ambient samples shall be collected first and placed in separate ice chests or shipping containers. Samples of waste or highly contaminated samples shall never be placed in the same ice chest as environmental samples. Ice chests or shipping containers for source samples or samples suspected to contain high concentrations of contaminants should be lined with new, clean, plastic bags.

- If possible, one member of the field sampling team should take all the notes, fill out tags, etc., while the other members collect the samples.

- When sampling surface waters, the water sample should always be collected before the sediment sample is collected.

- Sample collection activities should proceed progressively from the least suspected contaminated area to the most suspected contaminated area.

- Investigators should use equipment constructed of Teflon®, stainless steel, or glass that has been properly pre-cleaned for collection of samples for trace metals or organic compound analyses. Teflon® or glass is preferred for collecting samples where trace metals are of concern.

Sample Handling

After collection, all sample handling should be minimized. Investigators should use extreme care to ensure that samples are not contaminated. If samples are placed in an ice chest, investigators should ensure that melted ice can not cause the sample containers to become submerged, as this may result in sample cross-contamination. Plastic bags, such as Zip-Lock® bags or similar plastic bags sealed with tape, should be used when small sample containers (e.g., VOC vials or bacterial samples) are placed in ice chests to prevent cross-contamination.

Laboratory Procedures

The Tennessee Department of Health, Environmental Laboratory and Microbiological Laboratory Organization (Laboratory Services) has expertise in a broad scope of services and analysis available to the Tennessee Department of Environment and Conservation Department of Energy Oversight Division (the division) and other TDEC divisions statewide. General sampling and analysis methods are to follow Environmental Protection Agency (EPA) guidelines as listed in appropriate parts of 40 Code of Federal Regulations (CFR). Certain analyses and QC samples may be subcontracted out by Laboratory Services to independent laboratories. Bench level Quality Assurance/Quality Control (QA/QC) records and chain-of-custody records are maintained at the Tennessee Environmental Laboratory, as are QA records on subcontracted samples.

The division will use primarily the Knoxville branch of Laboratory Services. Wet chemistry and metals samples will generally be analyzed in Knoxville while organics samples will be sent on to the Central Laboratory in Nashville. All laboratory analysis will follow appropriate methods as documented in the Laboratory Services Inorganic Chemistry SOP and Organic Chemistry SOP. Specific analytical methods are covered in the Standard Operating Procedures (SOP) manuals for the Tennessee Laboratory Services Division. The SOPs direct analysts to the proper EPA or other methodology.

References

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CHAPTER 6 SURFACE WATER MONITORING

Ambient Sediment Monitoring Program

Introduction

Sediment samples are collected annually at sites on the Tennessee River, the Clinch River and some of its tributaries. The sediment samples are analyzed for organics, metals, and radiological contamination in order to assess the sediment quality for public health and ecological considerations. At this point there have been no observed temporal trends in the data.

The objective of this monitoring program is to assess the degree of sediment pollution of the Tennessee River, Clinch River and its tributaries.

Sample Locations

Site	Location	Clinch River Mile
2	Anderson County Water Treatment Plant	52.6
3	Downstream Williams Bend	35.5
4	Grubb Islands	17.9
5	Brashear's Island	10.1
6	Bull Run Steam Plant	48.7
7	Water Treatment Plant	41.2
8	Scarboro Creek	41.2*
9	Kerr Hollow Branch	41.2*
10	McCoy Branch	37.5*
11	Western Branch	37.5*
12	East Fork Walker Branch	33.2*
13	Bearden Creek	31.8*
17	Unnamed stream	20.0*
18	Raccoon Creek	19.5*
19	Ish Creek	19.1*
20	Grassy Creek	14.55*
21	Unnamed stream	14.55*
22	Unnamed stream	14.45*
23	Unnamed stream north of Pilot Knob and south of Warehouse Road	51.1*
24	White Creek	102.4*
25	Clear Creek	78.2*
26	Clinch River	9.0
27	Clinch River	7.0
28	Clinch River	4.0
29	Tennessee River at confluence of Clinch River	0.0
32	Clinch River Mile 19.7	19.7
33	Poplar Creek Mile 0.5	n.a.
34	Walker Branch	33.2*
35	Unnamed stream	18.7*
36	East Fork Poplar Creek Kilometer 6.3	n.a.

*These samples will be collected at a point on the tributary upstream of the river far enough to get a sediment and water sample that would be characteristic of the tributary and not be affected by the high flow of the river.

Methods and Materials

Parameters to be analyzed

Inorganics: aluminum, arsenic, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, and zinc

Organics (extractables): butylbenzylphthalate, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, di-n-octylphthalate, diethylphthalate, dimethylphthalate, n-nitrosodimethylamine, n-nitrosodiphenylamine, n-nitroso-di-n-propylamine, isophorone, nitrobenzene, 2,4-dinitrotoluene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, bis(2-chloroethyl) ether, bis(2-chloroethoxy)methane, bis(2-chloroisopropyl) ether, 4-bromophenylphenyl ether, 4-chlorophenylphenylether, hexachlorocyclopentadiene, hexachlorobutadiene, hexachlorobenzene, hexachloroethane, 1,2,4-trichlorobenzene, 2-chloronapthalene, 4-chloro-3-methyl phenol, 2-chlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 4,6-dinitro-o-cresol, 2-nitrophenol, 4-nitrophenol, pentachlorophenol, phenol, 2,4,6-trichlorophenol

Organics (pesticides/PCBs): aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC (lindane), technical chlordane, alpha-chlordane, gamma-chlordane, 4,4-DDD, 4,4-DDE, 4,4-DDT, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, heptachlor, heptachlor epoxide, toxaphene, methoxychlor, PCB 1016/1242, PCB 1221, PCB 1232, PCB 1248, PCB 1254, PCB 1260, PCB 1262

Radiological: gross alpha (total), gross beta (total), gross gamma (total), *gamma radionuclides:* ^{137}Cs, ^{40}K, ^{214}Pb, ^{214}Bi, ^{212}Pb, ^{228}Ac, ^{208}Tl, ^{212}Bi and others as detected.

Schedule

The ambient sediment monitoring will be conducted in the second quarter of 2005.

Sediment Standard Operating Procedures

Sediment analysis is a key component of environmental quality and impact assessment for rivers, streams, lakes, and impoundments. Samples can be collected for a variety of chemical, physical, toxicological and biological investigations. This procedure is to be used to obtain quality assured sediment sampling. The resulting data may be qualitative or quantitative in nature and is appropriate for use in preliminary surveys as well as confirmatory sampling.

Required Equipment

sampling platform/boat
depth finder
stainless steel petite ponar grab sampler
stainless steel mixing bowl
stainless steel spoon
pressurized water sprayer
deionized water
rubber gloves
aluminum foil
sample jars
sample labels
cooler/ice packs
scrubber
lab sheets
chain-of-custody forms
field notebook

Procedure

If the water is wadeable, one can collect a sediment sample by scooping the sediment using a stainless steel spoon or scoop. This can be accomplished by wading into the stream, and while facing upstream, scooping the sample along the stream bottom in the upstream direction. If one is sampling a deep lake or impoundment, one can use the Petite Ponar dredge to obtain a sample. Step by step directions are as follows:

Sediment sampling in wadeable streams and rivers

1. Locate suitable sampling site. Remember that a site immediately downstream of a riffle area has the greatest amount of deposition since the velocity of the stream slows down. Beware of constrictions in the stream where scouring may be occurring.
2. Don rubber gloves to avoid self-contamination during sampling.
3. Using decontaminated stainless steel spoon, obtain sediment sample by scraping the streambed in the upstream direction.
4. Place three samples scoops in a stainless steel bowl and mix thoroughly to obtain a homogeneous sample.
5. Have sediment samples surveyed by Radiological Monitoring.
6. Carefully transfer sample into the appropriate containers as stated by the state of Tennessee Labs.
7. Record all pertinent information on lab sheets, sample labels, and make necessary entries into field notebook.
8. Place all samples into cooler as soon as possible. Temperature within the cooler should be maintained at 4 C by using ice or freezer packs.
9. Rinse all equipment using scrubber brush and sprayer filled with deionized water.
10. Deliver sediment samples to state lab within appropriate holding time frames, and sign chain-of-custody forms.

Sediment sampling in lakes or reservoirs using Petite Ponar dredge

1. Don rubber gloves to avoid self-contamination during sediment sampling.
2. Place stabilizing pin into arm attachments to lock dredge jaws in open position.
3. Using dredge cable, carefully lower dredge through water column. Slow the descent just prior to contact with sediment to prevent any disturbance to the sediment.
4. As the dredge contacts the sediment, allow the line to go slack, which in turn releases the stabilizing pin.
5. Give a quick tug to the cable; this enables the dredge jaws to close. Carefully pull the dredge through the water column.
6. Obtain three sediment samples this way and place each of them into a stainless steel bowl.
7. Using a stainless steel spoon, thoroughly mix the sediment to obtain a homogeneous composite.
8. Have sediment sample surveyed by Radiological Monitoring.
9. Carefully transfer the collected sediment into appropriate sampling jars as stated by the state of Tennessee Labs.
10. Record all pertinent information on lab sheets, samples labels, and make necessary entries into field notebook.

11. Place sediment samples into cooler as soon as possible. Temperature within the cooler should be maintained at 4 C by using ice or freezer packs.
12. Rinse all equipment using scrubber brush and sprayer filled with deionized water.
13. Deliver samples to state lab within appropriate time frames. Be sure to sign all chain-of-custody forms.

Laboratory Procedures

The Tennessee Department of Health, Environmental Laboratory and Microbiological Laboratory Organization (Laboratory Services) has expertise in a broad scope of services and analysis available to the Tennessee Department of Environment and Conservation (TDEC) Department of Energy Oversight (DOE-O) and other TDEC divisions statewide. General sampling and analysis methods are to follow Environmental Protection Agency (EPA) guidelines as listed in appropriate parts of 40 Code of Federal Regulations (CFR). Certain analyses and QC samples may be subcontracted out by Laboratory Services to independent laboratories. Bench level Quality Assurance/Quality Control (QA/QC) records and chain-of-custody records are maintained at the Tennessee Environmental Laboratory as are QA records on subcontracted samples.

DOE-O will primarily use the Knoxville branch of Laboratory Services. Wet chemistry and metals samples will generally be analyzed in Knoxville while organics samples will be sent on to the Central Laboratory in Nashville. All laboratory analysis will follow appropriate methods as documented in the Laboratory Services Inorganic Chemistry SOP and Organic Chemistry SOP. Specific analytical methods are covered in the Standard Operating Procedures (SOP) manuals for the Tennessee Laboratory Services Division. The SOPs direct analysts to the proper EPA or other methodology.

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CHAPTER 6 SURFACE WATER MONITORING

ORR Surface Water Monitoring (Physical Parameters)

Introduction

Due to the presence of areas of extensive point and non-point source contamination on the Oak Ridge Reservation (ORR), there exists the potential for contamination to impact surface waters on the ORR. These events could cause the displacement of contamination that would not normally impact streams around the ORR.

To assess the degree of surface water impact relative to this potential contamination displacement, real time stream monitoring data will be collected semiweekly from a sitewide network of primary ambient monitoring stations to establish a database of physical stream parameters (i.e., conductivity, pH, temperature, dissolved oxygen, etc.). Furthermore, this monitoring task is directed toward determining long-term water quality trends, assessing attainment of water quality standards and providing background data for evaluating stream recovery due to toxicity insults (stressors). Table 1 is a list of seven (7) field monitoring sites that have been selected for data collection.

Table 1. Sample Locations

Site	Location
EFK 23.4	Station 17
EFK 13.8	Oak Ridge Sewage Treatment Plant
BCK 4.5	Bear Creek Weir at Hwy. 95
BCK 9.6	Bear Creek Monitoring Location
BCK 12.3	Bear Creek Monitoring Location
MIK 0.1	Mitchell Branch Weir
MBK 1.6	Mill Branch (Reference)

Methods and Materials

Surface water physical parameters to be collected semiweekly at the seven sites include: dissolved oxygen (DO), pH, temperature and conductivity. The three watersheds to be monitored include: (1) two sites at Mitchell Branch watershed (East Tennessee Technology Park), (2) two sites at East Fork Poplar Creek watershed (Y-12 National Security Complex), and (3) three sites at Bear Creek watershed (Y-12 National Security Complex).

The monitoring and parameter data collection will be conducted semiweekly (i.e., Mondays and Thursdays) at each of the monitoring stations (7 sites) listed in Table 1. It is estimated that approximately three hours per field trip will be required to collect data at all seven monitoring sites.

The instrument to be used for the project is the Horiba U-10™ Water Quality Checker (LCD readout). This state-of-the-art hand-held instrument is used for simultaneous multi-parameter measurement of water quality and measures the following: pH, conductivity, turbidity, dissolved oxygen, temperature, and salinity. The instrument consists of a probe unit (with various sensors) attached to a handheld unit (LCD readout & keypad) via a 3-foot cable. Measurements are taken

simply by immersing the probe directly into the creek, pond, or river, and parameter readings can then be recorded from the hand-held unit LCD readout (one parameter at a time is displayed and is initialized using the keypad).

In the event real-time field readings such as pH and conductivity are beyond benchmark ranges, then the following action will be taken: (1) wait 24 hours, re-calibrate Horiba™ instrument, and re-take physical parameter readings; (2) if readings are still deviant, investigate possible causes (e.g., defective equipment, storm surge/rain events, releases that may have affected pH, etc.); (3) following investigation, report findings to appropriate program(s) within the division to determine further action, if needed.

Standard Operating Procedures

Special care must be taken when monitoring water in which contaminants can be detected in the parts per billion and/or parts per trillion range. Also, proper maintenance and care of the Horiba U-10™ instrument is essential. The instrument should be recalibrated regularly. In order to prevent or minimize cross-contamination and to extend the life of the monitoring instrument, the following precautions are recommended as QA/QC procedures:

- The Horiba U-10™ instrument should be recalibrated prior to going to field each week.
- After instrument readings have been recorded at each monitoring station, the instrument probe should be rinsed and cleaned with deionized water (three times) before being used at the next monitoring site.
- The instrument probe parts should be thoroughly rinsed and cleaned prior to storage (after returning from each field outing). The Horiba U-10™ owners manual specifies that the pH sensor must always be kept moist during long term storage; also, remove the battery from the main unit prior to long term storage.
- If possible, one member of the field sampling team should take all the notes, fill out forms, etc., while the other member collects the field data using the Horiba U-10™ instrument.
- Sample collection activities should proceed progressively from the least suspected contaminated area to the most suspected contaminated area.

Sample Handling

No water quality samples will be collected during this project.

References

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CHAPTER 6 SURFACE WATER MONITORING

Ambient Surface Water Monitoring Program

Introduction

Surface water sampling is conducted twice a year at 26 sites located on the Clinch River and it's tributaries. The surface water samples are analyzed for metals, nutrients and other parameters in order to assess the water quality for public health and ecological considerations. Sampling sites 1, 2, 24, and 25 are background data collection sites and are located upstream of the Oak Ridge Reservation (ORR). The other sites were chosen to detect contaminants being transported by surface water or stormwater coming from the ORR or areas affected by Department of Energy (DOE) related activities. At this point there have been no observed temporal trends in the data.

To assess the degree of surface water pollution of the Clinch River and its tributaries, the sites will be sampled semiannually. The water samples will be analyzed for certain inorganic (metallic and non-metallic) materials, environmental microbiological attributes, and some physical characteristics.

Sample Locations

Site	Location	Clinch River Mile
1	Downstream of Norris Dam, Clinch River	78.7
2	Anderson County Water Treatment Plant	52.6
3	Downstream of Williams Bend	35.5
4	Grubb Islands	17.9
5	Brashear's Island	10.1
6	Bull Run Steam Plant	48.7
7	Water Treatment Plant	41.2
8	Scarboro Creek	41.2*
9	Kerr Hollow Branch	41.2*
10	McCoy Branch	37.5*
11	Unnamed Stream	37.5*
12	East Fork Walker Branch	33.2*
13	Bearden Creek	31.8*
17	Unnamed Stream	20.0*
18	Raccoon Creek	19.5*
19	Ish Creek	19.1*
20	Grassy Creek	14.55*
21	Unnamed Stream	14.55*
22	Unnamed Stream	14.45*
23	Unnamed Stream south of Warehouse Rd.	51.1*
24	White Creek	102.4*
25	Clear Creek	77.7*
32	Clinch River Mile 19.7	19.7
33	Poplar Creek Mile 0.5	12.0
34	Walker Branch	33.2*
35	Unnamed Stream	18.7*

*These samples will be collected at a point on the tributary upstream of the river far enough to get a water sample that would be characteristic of the tributary and not be affected by the high flow of the river.

Methods and Materials
Parameters to be analyzed

Inorganics: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, zinc, nitrogen (NO_2 & NO_3), ammonia, nitrogen (total Kjeldahl), total phosphorus.

Other tests: E. coli, Enterococcus, COD, dissolved residue, suspended residue, total hardness.

Schedule
The ambient water monitoring will be conducted in the second and fourth quarters.

Standard Operating Procedures
Special care must be taken when sampling water in which contaminants can be detected in the parts per billion and/or parts per trillion range. In order to prevent cross-contamination of these samples, the following precautions shall be taken when trace contaminants are of concern:

- A clean pair of new, non-powdered, disposable vinyl gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should not come into contact with the media being sampled.

- Sample containers for source samples or samples suspected of containing high concentrations of contaminants should be placed in separate plastic bags immediately after collecting, tagging, etc.

- If possible, ambient samples and source samples should be collected by different field teams. If different field teams cannot be used, all ambient samples shall be collected first and placed in separate ice chests or shipping containers. Samples of waste or highly contaminated samples shall never be placed in the same ice chest as environmental samples. Ice chests or shipping containers for source samples or samples suspected to contain high concentrations of contaminants should be lined with new, clean, plastic bags.

- If possible, one member of the field sampling team should take all the notes, fill out tags, etc., while the other members collect the samples.

- When sampling surface waters, the water sample should always be collected before the sediment sample is collected.

- Sample collection activities should proceed progressively from the least suspected contaminated area to the most suspected contaminated area.

- Investigators should use equipment constructed of Teflon®, stainless steel, or glass that has been properly precleaned (Appendix B) for collection of samples for trace metals or organic compounds analyses. Teflon® or glass is preferred for collecting samples where trace metals are of concern. Equipment constructed of plastic or PVC shall not be used to collect samples for trace organic compounds analyses.

Sample Handling

After collection, all sample handling should be minimized. Investigators should use extreme care to ensure that samples are not contaminated. If samples are placed in an ice chest, investigators should ensure that melted ice cannot cause the sample containers to become submerged, as this may result in sample cross-contamination. Plastic bags, such as Zip-Lock® bags or similar plastic bags sealed with tape, should be used when small sample containers (e.g., VOC vials or bacterial samples) are placed in ice chests to prevent cross-contamination.

Laboratory Procedures

The Tennessee Department of Health, Environmental Laboratory and Microbiological Laboratory Organization (Laboratory Services) has expertise in a broad scope of services and analysis available to the Tennessee Department of Environment and Conservation (TDEC) Department of Energy Oversight (DOE-O) and other TDEC divisions statewide. General sampling and analysis methods are to follow Environmental Protection Agency (EPA) guidelines as listed in appropriate parts of 40 Code of Federal Regulations (CFR). Certain analyses and QC samples may be subcontracted out by Laboratory Services to independent laboratories. Bench level Quality Assurance/Quality Control (QA/QC) records and chain-of-custody records are maintained at the Tennessee Environmental Laboratory, as are QA records on subcontracted samples.

DOE-O will primarily use the Knoxville branch of Laboratory Services. Wet chemistry and metals samples will generally be analyzed in Knoxville while organics samples will be sent on to the Central Laboratory in Nashville. All laboratory analysis will follow appropriate methods as documented in the Laboratory Services Inorganic Chemistry SOP and Organic Chemistry SOP. Specific analytical methods are covered in the Standard Operating Procedures (SOP) manuals for the Tennessee Laboratory Services Division. The SOPs direct analysts to the proper EPA or other methodology.

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